THE CARL MOYER PROGRAM GUIDELINES

PART II of IV

PROJECT CRITERIA

Proposed Revision 2005
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Chapter One

ON-ROAD HEAVY-DUTY VEHICLES

This chapter addresses the project criteria for on-road heavy-duty vehicles (HDVs). It also contains a brief overview of the HDV emission inventory, current engine emission standards and regulations impacting HDVs, available control technologies, potential projects eligible for funding, and cost-effectiveness calculations. Since the 2003 Guidelines, the Air Resources Board (ARB or Board) has adopted many regulations that affect existing heavy-duty vehicles. The proposed project criteria in this chapter have been updated to reflect these new regulatory requirements. The Carl Moyer Program provides financial incentives to pay for the incremental cost of cleaner-than-required HDVs, new purchases, repowers, and retrofits.

I. Introduction

On-road HDVs encompass a large variety of vehicles such as buses, solid waste collection vehicles, street sweepers, delivery trucks and more. These vehicles are typically categorized by weight. Vehicles greater than 8,501 pounds (lbs) gross vehicle weight rating (GVWR) are considered to be HDVs which can also be subcategorized as light heavy duty (LHD), medium heavy-duty (MHD) and heavy heavy-duty (HHD) vehicles (see Table 1-1).

Table 1-1
Heavy-Duty Vehicle Classifications

Vehicle Classification	GVWR
Light Heavy-duty (LHD)	8,501 ≤ 14,000 lbs
Medium Heavy-Duty (MHD)	14,001 ≤ 33,000 lbs
Heavy Heavy-Duty (HHD)	33,001 or more lbs

HDVs can also be further categorized by use and fuel type. Regulations traditionally refer to the vehicle usage type such as solid waste collection vehicles (SWCV), urban buses, and street sweepers. Section III of this chapter provides information on regulations that currently impact these vehicles.

Fuel types for HDVs include diesel, alternative diesel fuels, compressed natural gas (CNG), liquefied natural gas (LNG), liquefied propane gas (LPG), gasoline and electricity. The majority of HDVs are powered by compression-ignition engines typically fueled with diesel fuel. This preference for diesel engines presents an air quality challenge since diesel emissions of oxides of nitrogen (NOx) and particulate matter (PM) have not been able to be controlled to the extent that gasoline-fueled vehicle emissions have, particularly for light and medium-duty vehicles. Furthermore, HDVs involved in the transport of goods typically accrue higher annual mileage than other

vehicles. Consequently, the share of total emissions from HDVs is disproportionately higher than their population would suggest.

II. Emissions

Even though the population of all HDVs, including urban buses, account for approximately one percent of all on-road vehicles, they emit about 55 percent of the on-road statewide NOx emissions, 14 percent of the statewide reactive organic gases (ROG) emissions and 35 percent of the statewide PM10 emissions. As shown in Table 1-2, the NOx, ROG and PM10 annual emissions from HDVs will decrease through 2010. However, it is important to note that emissions from other on-road motor vehicle categories will also decrease, and by 2010, HDVs will contribute an even larger share of the emissions from motor vehicles. In addition, daily vehicle miles traveled (VMT) by HDVs are projected to increase by about 11 percent from 2005 to 2010. Clearly, emissions from heavy-duty vehicles have to be reduced further if California is to achieve its air quality goals.

Table 1-2
Heavy-Duty Vehicle Annual Emissions*
Vehicles Greater than 8,500 Pounds

	VMT	NOx tpd	ROG tpd	PM10 tpd
2005	61,446,000	839	107	18
2010	69,112,000	654	84	15

* 2005 Almanac

III. Regulatory Requirements

All HDVs sold in California have engines that have been certified to specific standards. Those standards are, in general, consistent nationwide and are discussed below. Urban transit buses are an exception, having more stringent requirements than other HDVs. All new purchases funded by the Carl Moyer Program must be surplus to these minimum requirements.

In addition, the ARB has developed, or is in the process of developing, additional regulations which will overlay these new engine standards for specific categories. These categories, discussed below, include transit vehicles, solid waste collection vehicles, school bus, public fleets and private fleets. Any Carl Moyer Program project must be surplus to these regulations.

A. Emission Standards

Engine emission standards have progressively and substantially reduced NOx and PM emissions from HDVs. Table 1-3 lists the existing and future NOx and PM emission standards for heavy-duty engines as found in Title 13, California Code of Regulations

(CCR), section 1956.8 [ARB, 2002a]. Urban buses have a separate set of standards and are shown in Table 1-4 as found in Title 13, CCR, section 1956.1 [ARB, 2002b].

Table 1-3
Emission Standards for Heavy-Duty Diesel Engines
(grams per brake horsepower-hour (g/bhp-hr))

	Heavy-Duty Vehicles		Heavy-Duty Optional Standard (4)	
Model Year	**NOx**	**PM**	**NOx + NMHC**	**PM**
2004 - 2006	2.4(1) or 2.5(2)	0.1	1.8 - 0.3	0.03 - 0.01
2007	1.2(3)	0.01	-	-
2010	0.2	0.01	-	-

(1) NOx plus NMHC
(2) NOx plus NMHC with 0.5 g/bhp-hr NMHC cap
(3) Between 2007-2009, U.S. EPA requires 50 percent of heavy-duty diesel engine family certifications to meet the 0.2 g/bhp-hr NOx standard. Averaging is allowed, and it is expected that most engines will conform to the fleet NOx average of approximately 1.2 g-bhp/hr.
(4) Optional Standard sunsets on December 31, 2006

Table 1-4
Emission Standards for Urban Buses
(g/bhp-hr)

	Diesel Urban Bus		Alt Fuel Urban Bus		Alt Fuel Urban Bus Optional Standard (4)	
Model Year	**NOx**	**PM**	**NOx**	**PM**	**NOx + NMHC**	**PM**
2004 - 2006	0.5(1)	0.01	2.4(2) or 2.5(3)	0.01	1.8 - 0.3	0.03 - 0.01
2007	0.2	0.01	0.2	0.01	-	-
2010	0.2	0.01	0.2	0.01	-	-

(1) Standard applies to urban bus equipped with diesel-fuel, dual fuel, or bi-fuel engines.
(2) NOx plus NMHC
(3) NOx plus NMHC with 0.5 g/bhp-hr NMHC cap
(4) Standard sunsets on December 31, 2006

B. Fleet Regulation for Transit Agencies

1. Transit Fleet Vehicles

The fleet regulation for transit agencies was amended by the Board on February 24, 2005 [ARB, 2005]. This regulation impacts vehicles owned or operated by a transit agency. The specific transit fleet vehicles impacted are on-road vehicles 8,501 pounds GVWR or greater powered by a heavy-duty engine fueled by diesel or alternative fuel that are not urban buses. Transit agencies operating only gasoline-powered vehicles are not subject to this regulation.

The regulation establishes a fleet average NOx standard and PM emission reduction requirement for transit fleet vehicles phased-in between 2007 and 2010. Transit fleet vehicles are subject to the heavy-duty diesel engine emission standards and not the urban bus engine exhaust emission standards.

A transit agency must meet NOx emission averages of 3.2 g/bhp-hr by December 31, 2007, and 2.5 g/bhp-hr by December 31, 2010, from its transit fleet vehicles. A transit agency must also reduce diesel PM emissions of its transit fleet vehicles by 40 percent as of December 31, 2007, and 80 percent as of December 31, 2010, compared to the agency's baseline emissions as of January 1, 2005.

2. Urban Bus

An urban transit bus is a passenger-carrying vehicle powered by a heavy heavy-duty diesel engine with a load capacity of fifteen or more passengers and intended primarily for short rides and frequent stops. Urban transit buses statewide are subject to ARB's Public Transit Agency Vehicle regulation amended in 2005. The regulation required transit agencies that own, operate or lease urban buses to choose a diesel fuel or alternative fuel path and follow the requirements as described for each fuel path.

Agencies on the alternative fuel path are required to:

- Purchase or lease alternative fuel buses that meet the current standards for 85 percent of the annual purchases made by the agency, through 2015.
- Only purchase new buses with an engine certified to an optional PM standard of 0.03 g/bhp-hr or lower.
- Agencies established before January 1, 2005 that are on the alternative-fuel path shall not operate an active fleet of urban buses with:
  - Average NOx emissions in excess of 4.8 g/bhp-hr, based on the engine certification standards of the engines in the active fleet.
  - Diesel PM emission totals exceeding:
    (1) 60 percent of the agency's January 1, 2002 diesel PM average through December 31, 2006.
    (2) 40 percent of the agency's January 1, 2002 diesel PM average beginning January 1, 2007.

Agencies on the diesel fuel path are required to:

- Purchase a diesel-fueled, dual-fueled or bi-fueled bus with 2004-2006 MY engines certified to 0.5 g/bhp-hr of NOx and 0.01 g/bhp-hr of PM or an alternative fuel bus with an engine certified to an optional PM standard of 0.03 g/bhp-hr or lower.
- Agencies established before January 1, 2005 that are on the diesel fuel path shall not operate an active fleet of urban buses with:
  - Average NOx emissions in excess of 4.8 g/bhp-hr, based on the engine certification standards of the engines in the active fleet.
  - Diesel PM emission totals exceeding:

(1) 40 percent of the agency's January 1, 2002 diesel PM average through December 31, 2006.
(2) 15 percent of the agency's January 1, 2002 diesel PM average or equal to 0.01 g/bhp-hr times the total number of current diesel-fueled active fleet buses whichever is greater beginning January 1, 2007.

Agencies established after January 1, 2005, regardless of which path they choose, shall not operate an active fleet of urban buses with:

- Average NOx emissions in excess of 4.0 g/bhp-hr, or the NOx average of the active fleet of the transit agency from which it was formed whichever is lower, or in the case of a merger of two or more transit agencies or parts of two or more transit agencies, the average of the NOx fleet averages, whichever is lower.
- Diesel PM exhaust emissions exceeding the following values:
  (1) Through December 31, 2009, 0.05 g/bhp-hr times the total number of diesel-fueled buses in the active fleet.
  (2) As of January 1, 2010, 0.01 g/bhp-hr times the total number of diesel-fueled buses in the active fleet.

C. Solid Waste Collection Vehicles

SWCVs are on-road heavy-duty vehicles with a GVWR of 14,000 pounds or more and are used for the purpose of collecting residential and commercial solid waste. SWCV are subject to a statewide diesel PM control measure adopted by the Board on September 23, 2003 [ARB, 2004]. The regulation requires each owner to use one of the best available control technologies (BACT) as described in the regulation on each engine or collection vehicle in the fleet.

BACT, as defined by the regulation, can be summarized as an engine or power system certified to the optional 0.01 g/bhp-hr PM standard; an engine or power system certified to the 0.1 g/bhp-hr PM emission standard, used in conjunction with the highest level diesel emission control system (DECS); an alternative fuel or heavy-duty pilot ignition engine, model year 2004 – 2006 certified to the optional standard; or the highest level diesel emission control strategy that is verified.

BACT compliance deadlines are phased in, and are based on a group of engine model years as listed in Table 1-5. It is important to note that Group 2 requirements apply to specific model years (MY) based on the fleet size. Compliance deadlines begin in 2004 and continue through 2010.

Table 1-5
Implementation Schedule for Solid Waste Collection Vehicles, Model Years 1960 to 2006

Group	Engine Model Years	Percentage of Group to Use Best Available Control Technology	Compliance Deadline
1	1988 – 2002	10 25 50 100	December 31, 2004 December 31, 2005 December 31, 2006 December 31, 2007
2a	1960 – 1987 (Total fleet ≥ 15 collection vehicles)	15 40 60 80 100	December 31, 2005 December 31, 2006 December 31, 2007 December 31, 2008 December 31, 2009
2b	1960 – 1987 (Total fleet < 15 collection vehicles)	25 50 75 100	December 31, 2007 December 31, 2008 December 31, 2009 December 31, 2010
3	2003 – 2006 (Includes dual-fuel and bi-fuel engines)	50 100	December 31, 2009 December 31, 2010

D. Upcoming Regulations

Municipal or utility-owned on-road heavy-duty diesel-fueled vehicles, such as dump trucks, street sweepers, and aerial lift trucks are not currently regulated by a fleet rule. The Board will consider a proposed in-use diesel particulate control measure for public and utility fleets in December 2005 which may impact the project criteria for these projects. Due to low mileage, these projects are generally only eligible for small grant amounts.

Private on-road heavy-duty diesel-fueled vehicle fleets such as in-use heavy-duty trucks are not currently regulated. The Board will also hear a proposed diesel particulate control measure for private fleets in 2006 which may impact the project criteria for these projects.

IV. Potential Project Types

The Carl Moyer Program can achieve emission reductions from heavy-duty vehicles operating in California. The project criteria are designed to ensure that the emission reductions expected through the deployment of low-emission engines or retrofit technologies under this program are surplus, real, quantifiable, and enforceable.

There are four main types of HDV projects: new purchases, repowers, retrofit, and alternative fuels. Each of these are discussed below.

Commercially available low-emission HDVs are considered suitable Carl Moyer Program projects, either as new engine/vehicle purchases or new engine purchases for vehicle repowers. Recent statutory changes now allow for the potential to fund LHD projects. Due to the uncertainty of future requests, LHD projects will be considered initially on a case-by-case basis. If an appreciable number of applications are received for LHD projects, ARB will develop specific guidance.

Diesel engines, due to their high efficiency and long life, dominate the HDV markets. However, their typical lean-burn, high-compression, high-temperature operation has resulted in technical limitations for achieving significant NOx emission reductions. Alternative fuel engines, especially those fueled by CNG and LNG, have been able to achieve NOx emissions of about half of a conventional diesel engine. Alternative fuel engines, including LPG engines, are available for MHD truck applications and HHD engines used in trash truck applications.

In 2010, both the alternative-fuel and diesel fuel standards will align at 0.2 g/bhp-hr NOx. As a result, engine manufacturers have invested significant resources for the development of reduced-emission diesel engines and progress has been made, especially with the integration of advanced electronics, the use of exhaust gas recirculation, and after treatment devices. Today's generation of HD diesel engines are nearly as clean as some of the alternative-fuel engines produced prior to 2003. Nevertheless, it is likely that only alternative-fuel engines will meet the lower NOx emission standard requirements for Carl Moyer Program funding for new purchases at this time.

The variety of alternative fuel engines available and the number sold in California has increased significantly. However, due to increasingly stringent emission standards, the number of available alternative fuel engines being certified each year has decreased. As engine technology matures, the number and variety of engines certified to the emission standards will expand. Alternative fuel vehicles have had the most success in the urban bus market. Presently, approximately 50 percent of all bus sales in California are alternative fuel vehicles and a significant number of transit agencies have focused exclusively on alternative fuel buses for new purchases.

A. New Vehicle Purchase

New vehicle purchases of LNG and CNG HDVs are expected to continue to be the most common type of project for on-road heavy-duty vehicles under the Carl Moyer Program, although LPG vehicles continue to be an option. The ARB certifies engines destined for sale in California and provides the engine manufacturers with an Executive Order (EO) for each certified engine family which is used to determine eligibility for new vehicle purchases and engine repowers. To be eligible, the new vehicle/engine must be certified to one of the ARB's current optional NOx emission standards of

1.8 g/bhp-hr NOx through 2006, regardless of fuel type or engine design. Beginning in January 2007, the optional standards will sunset, and projects for new vehicle/engine must be certified to 0.2 g/bhp-hr of NOx.

The Heavy-Duty Diesel-Engine and Vehicle Standard will continue to be used as the baseline for determining eligibility for on-road new purchases except urban buses. Engines and vehicles certified to the Heavy-Duty Otto-Cycle Engine Standard may also be eligible for funding if certified to a level equivalent to the current optional diesel standard or 30 percent less than the current diesel standard. Since new engines are certified throughout the year, districts are encouraged to contact ARB for the most current list of eligible engines.

Purchases of new vehicles must also be beyond the requirements of ARB's regulations. Thus, applicants must submit evidence of compliance with the regulations or documentation to support that Carl Moyer Program funds will not be used to meet regulatory requirements.

Heavy-duty hybrid electric vehicle purchases are another new vehicle purchase project type eligible for Carl Moyer funding. Heavy-duty hybrid-electric propulsion systems combine two motive power sources: an energy storage system such as batteries or ultra-capacitors, and an internal combustion engine, turbine, or fuel cell functioning as an auxiliary power unit. An electric motor provides partial or complete power to the wheels. In addition, energy otherwise lost as heat during braking is captured through regenerative braking to charge the energy storage system.

In order to qualify for the Carl Moyer Program, the hybrid-electric drive system must be certified using the "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes." These test procedures provide a method to quantify the emission benefits of a hybrid-electric drive system which is not possible through engine certification methods. At this time, one gasoline hybrid-electric drive system for use in urban buses is certified to the optional NOx standards at 0.6 g/bhp-hr and is classified as an alternative fuel bus.

Average Banking and Trading (ABT) engines (i.e., all Family Emission Limit (FEL)-certified engines) are not eligible to participate in the Carl Moyer Program for new vehicle purchase projects since emission benefits from an engine certified to an FEL level are not surplus emissions.

B. Repower

Vehicle repower refers to the replacement of an existing engine with a newer engine certified to lower emission standards. For the Carl Moyer Program, existing HDV engines, regardless of model year, must be repowered with an ARB certified engine, Model Year 1991 or newer. Engine repowers are allowed only when the highest available ARB verified retrofit is installed as part of the repower project. All other eligibility criteria must also be met. Under the Carl Moyer Program, funding is not

available for projects in which spark-ignition engines (i.e., natural gas or gasoline, etc.) are replaced with new diesel engines.

Replacement of an old mechanical engine with a newer mechanical engine that is certified to a lower NOx emission standard may be cost-effective. (Mechanical engines are those having mechanically-controlled injection timing. These engines are common in pre-1991 models). Some air districts have also expressed interest in mechanical-to-electronic engine repowers for on-road heavy-duty engines. Although substantial NOx emission reductions may occur in these types of projects, installation of an electronically controlled engine into a mechanical engine platform is difficult due to the significant differences in fuel and electrical systems. Thus, mechanical-to-electronic engine repower projects will be considered on a case-by-case basis.

Another possible repower option is the use of an engine that was certified to a FEL level as the replacement engine. FEL engines can be funded for vehicle repower projects only if they are certified to a level that is below the required emission standard. Due to the possibility of emission credits being generated from FEL engine averaging, specific guidelines must be followed when calculating emission reductions. These Guidelines are explained in the repower portion of the Project Criteria section below.

C. Retrofit

Retrofit involves modifications to an engine and/or fuel system such that the retrofitted engine does not have the same specifications as the original engine. Retrofit projects are allowed for all engine model years, regardless of mechanical or electronic control. The most straightforward retrofit projects are add-on after treatments. ARB has approved formal verification procedures for several retrofit kits and diesel emission control strategies. The verification process is ongoing, and districts are encouraged to contact ARB to obtain the most current list of eligible retrofits. Retrofits may also include engine and/or fuel system component upgrades that could be done at the time of an engine rebuild, resulting in a lower emission configuration. See Appendix F for more detailed information regarding retrofits.

D. Alternative Fuel

Districts have the option to fund the cost difference between conventional diesel fuel and an alternative fuel such as alternative-diesel fuel, CNG, LNG, and LPG with matching funds. The fuel purchase must be an integral part of an engine purchase, repower, or retrofit.

V. Proposed Project Criteria

Reduced-emission on-road heavy-duty vehicle projects which include new vehicle purchase, vehicle engine replacement (repower), and engine retrofit, can be considered for incentive funding. The project criteria listed below for on-road heavy-duty vehicles provide districts, fleet operators, transit agencies, and applicants with the minimum

qualifications for the Carl Moyer Program. The primary criteria for selection are: emission reductions, cost-effectiveness, and ability for the project to be completed within the timeframe of the program. Sample calculations that illustrate the methodology for determining emission reductions and cost-effectiveness are included in Appendices C and D.

Participating districts retain the authority to impose additional requirements in order to address local concerns.

A. General

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding with a regulatory agency, settlement agreement, mitigation requirement, or other legal mandate.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to offset any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging banking and trading program.

- Projects must have a minimum project life of three years. ARB may approve a shorter project life on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The contract term must extend to the end of the project life.

- Funded projects must have at least 75 percent of the vehicle's annual miles traveled in California.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the air district suggests potential surplus, real, quantifiable and enforceable emission reduction benefits.

- Vehicles operating under a compliance extension granted by the ARB, a local district, or the U.S. EPA are not eligible for funding.

- Default project life for on-road projects are as follows:

School buses ≥ 33,000 GVWR - New	20 years
Buses ≥ 33,000 GVWR - New	12 years
Other On-road - New	10 years
Repowers + Retrofits	5 years
Retrofits	5 years

  Applicants must provide documentation to justify a longer project life. The default project life does not consider upcoming regulatory requirements. Project life may be shorter due to regulatory requirements.

- On-road heavy-duty diesel vehicles with a gross vehicle weight rating between 8,501 and 14,000 pounds may be considered for Carl Moyer Program funding for new, repower and retrofit projects on a case-by-case basis.

- All engines in new purchases and repower projects must be certified by the ARB for sale in California and must comply with durability and warranty requirements.

- All aftermarket emission controls (retrofits) must be verified by ARB.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

B. Compliance Check

After the district qualifies on-road repower and retrofit projects for funding but before the district APCO signs an agreement for funding a project, the district must submit information regarding the project to ARB to check for outstanding violations. The process for completing the compliance check is as follows:

- The district shall email their ARB district liaison the contact name, organization or business name and vehicle identification number for the project.

- The liaison will forward that information electronically to the responsible parties at ARB. The liaison will email the district the results of the compliance check within seven working days.

- If the compliance check indicates there is an outstanding violation the district shall inform the engine owner in writing that no disbursement may be made until the owner provides proof that the violation has been corrected and the fines have been paid.

- If the outstanding violation is based on problems with the baseline engine (e.g., gross polluter) the new engine must be installed (instead of fixing the old engine), the vehicle must be operational, the engine owner must pay the violation and submit

documentation of the violation being corrected with, or before submitting, the invoice.

- During inspections, districts must also check for a sticker verifying engines subject to the software upgrades for diesel trucks (i.e., chip reflash) have completed the upgrade before receiving funding.

C. New Purchase

The following criteria apply to all on-road new vehicle purchases

- Projects must provide at least a 30 percent NOx emission reduction compared to baseline NOx emission factors for the specific vehicle type.

- Fleets/agencies affected by upcoming fleet regulations may use Carl Moyer Program funding to purchase a new vehicle if the project life expires prior to the final compliance date for the reductions in the regulation. For example, if a project with a 3-year project life is funded in December 2006, the emission reductions must be surplus to any emission reductions that are required by any regulations that apply through December 2009.

- Fleets/agencies purchasing vehicles that will be affected by upcoming emission standards may use Carl Moyer funding to purchase a new vehicle up to the compliance date of the new standard.

- The Heavy-Duty Diesel-Engine and Vehicle Standard will be used as the baseline for determining eligibility for on-road new purchases. Engines and vehicles certified to the Heavy-Duty Otto-Cycle Engine Standard may be eligible if certified to a level equivalent to the current optional diesel standard or 30 percent less than the current diesel standard.

- Through 2006, new vehicles eligible for the Carl Moyer Program must have engines certified to an optional, low-emission standard of 1.8 g/bhp-hr NOx + NMHC or less.

- From 2007 to 2009, new vehicle engines eligible for the Carl Moyer Program must be certified to a 0.2 g/bhp-hr NOx emission limit.

- Engines used in any ABT program are not eligible for funding.

D. Repower

The following criteria apply to all on-road repower (engine replacement) projects.

- Repower replacement engines must be an ARB certified engine with a Model Year of 1991 or newer.

- On-road engine repowers are allowed only when the highest available ARB retrofit is installed as part of the repower project.

- If a repower project does not meet the weighted cost-effective limit due to a retrofit, then the project is only eligible for the cost up to the weighted cost-effective limit.

- If during data logging the retrofit is proven not to be technically feasible for the replacement engine of the repower project then other retrofits must be examined for usability. If no retrofit is shown to be technically feasible to the district and ARB, the retrofit is not required. However, at any time during the project life, if a retrofit that is compatible with the engine and the vehicle duty cycle has been verified by ARB it must be installed.

- Repower projects that reduce NOx emissions must be certified by ARB to a NOx reduction level of at least 15 percent from the baseline engine.

- Fleets/agencies affected by upcoming fleet regulations may use Carl Moyer funding for repower projects if the project life expires prior to the final compliance date for the reductions in the regulation. For example, if a project with a 3-year project life is funded in December 2006, the emission reductions must be surplus to any emission reductions that are required by any regulations that apply through December 2009.

- Funding requests for other related repowering equipment, such as the vehicle transmission, will be considered on a case-by-case basis, based upon whether it is a necessary expense, and is at the discretion of the district.

- The full cost of a retrofit kit included in a repower project may be funded subject to the $14,300 weighted cost-effectiveness limit.

- The replacement engine used in vehicle repower projects may be a new, rebuilt, or remanufactured engine. Eligible rebuilt or remanufactured engines are those offered by the original engine manufacturer (OEM) or by a non-OEM rebuilder who demonstrates to the ARB that the rebuilt engine and parts are functionally equivalent from an emissions and durability standpoint to the OEM engine and components being replaced. Rebuild and remanufactured engines that are not re-certified to new emission standards, shall use the emission standards associated with the original engine block.

- For repowers, replacement engines manufactured after September 30, 2002, that are not certified to at least the 2.4 g/bhp-hr NOx + NMHC, or 2.5 g/bhp-hr NOx + NMHC with a 0.5 g/bhp-hr NMHC cap, are ineligible to participate in the Carl Moyer Program.

- Engines that are certified to a FEL NOx or NOx + NMHC level that is lower than the required emission standard are eligible for use in vehicle repower projects.

However, the emission level that can be used in cost-effectiveness calculations for these engines would be the applicable emission standards and not the FEL levels.

- Replacement engines subject to the software upgrades for diesel trucks (i.e., chip reflash) must complete the software upgrade process before being installed in a vehicle. The cost of the software upgrade, if any, is not an eligible Carl Moyer Program expense.

- Mechanical-to-electronic engine repower projects will be considered on a case-by-case basis.

- Funding is not available for projects to replace spark-ignition engines (i.e., natural gas or gasoline, etc.) with diesel engines.

E. Retrofit

The following criteria apply to all on-road retrofit projects:

- Only ARB-verified retrofits are eligible for funding.

- Retrofit projects that reduce NOx emissions must be verified by ARB to a NOx reduction level of at least 15 percent from the baseline engine.

- Retrofit projects that control PM must use the highest level cost-effective technology available for the equipment being retrofitted. The following are the diesel PM reductions for each ARB verified level: Level 1 (25 percent reduction), Level 2 (50 percent reduction), or Level 3 (85 percent reduction).

- Fleets/agencies affected by upcoming fleet regulations may use Carl Moyer funding for retrofit projects if the project life expires prior to the final compliance date for the reductions in the regulation. For example, if a project with a 3-year project life is funded in December 2006, the emission reductions must be surplus to any emission reductions that are required by any regulations that apply through December 2009.

- If the retrofit device reduces both NOx and PM emissions and is being installed to comply with a PM requirement, only the cost of the NOx reductions are eligible for Carl Moyer Program funding.

- The cost of the retrofit, and all filters needed during the project life, may be paid for with Carl Moyer Program funding provided it meets the weighted cost-effectiveness limit.

F. Scrap

- Scrap requirements are described in the Administrative Chapter of these Guidelines

G. Fuel

- Carl Moyer funds can not be used for fuel projects, however funds under a district's budgetary authority or fiduciary control (i.e. match funds) may be used to pay for the incremental cost of liquid or gaseous fuel, other than standard gasoline or diesel, which is integral to a covered emission reducing technology that is part of a project receiving grant funding under the Program. If all Carl Moyer Program criteria are met and the project is not a “fuel-only” project, the incremental cost of alternative fuel can be considered a qualified matching contribution from a district.

H. Glider Kits

- An engine repower for a glider kit (replacement cab and chassis) is eligible for funding. The replacement engine must be newer than the glider kit and meet the general program criteria above.

- Glider kits are not an eligible expense under the Carl Moyer Program.

I. Heavy-Duty Trucks

Currently, most in-use heavy-duty trucks, or heavy-duty vehicles designed to carry an entire load such as long-haul, short-haul, delivery, and construction trucks, are not subject to any fleet rules. The ARB is developing a fleet rule for private heavy-duty vehicles that is tentatively scheduled to be presented to the Board in 2006. If approved, it may affect the project criteria for these projects. Eligible heavy-duty truck projects including new vehicle purchases, repowers, and retrofits are subject to the general criteria cited above.

- Heavy-duty trucks are eligible for funding if they meet the general program criteria above.

- Hybrid electric vehicle (HEV) new purchases will be considered on a case-by-case basis if the HEV is certified to the current NOx and PM standards.

J. Private Fleets

Private on-road heavy-duty diesel vehicle fleets are not currently regulated by a fleet regulation. The Board is tentatively scheduled to consider a proposed diesel particulate control measure for these fleets in 2006 which may affect the project criteria for these projects.

- Private fleet vehicles are eligible for funding if they meet the general program criteria above.

K. Public and Utility Fleets

Municipal and utility-owned on-road heavy-duty diesel-fueled vehicles are not currently regulated by a fleet regulation. The ARB will consider a proposed diesel particulate control measure for these fleets in December 2005 which may affect the project criteria for these projects. Due to low mileage, these projects are generally only eligible for small grant amounts.

- Public and utility fleet vehicles are eligible for funding if they meet the general program criteria listed above.

L. School Buses

School buses are vehicles used for the express purpose of transporting students through grade 12 from home to school, school to home and to any school sponsored activities.

- School buses are eligible for Carl Moyer Program funding if they meet the general program criteria above; however, their relatively low annual miles traveled usually allows for minimum grant amounts.

M. Solid Waste Collection Vehicles

SWCVs are on-road heavy-duty vehicles with a GVWR of 14,000 pounds or more that are used for the purpose of collecting residential and commercial solid waste. SWCVs are subject to a statewide in-use diesel particulate matter airborne toxic control measure (ATCM). Projects that meet the following criteria provide emission reductions that are surplus to the regulatory requirements and may be funded:

- Projects are subject to the general program criteria listed above.

- Projects will be considered on a case-by-case basis. All SWCV projects must submit evidence of compliance with the SWCV rule or documentation to show that the funds will not be used to meet the rule's requirements. Documentation must include the name of the company, address, and fleet terminal(s) names and locations. Documentation must also include company records identifying the vehicles in their total fleet including: listing them by the terminals out of which they operate, model years of vehicles and engines in the fleet, vehicle identification number, serial numbers, engine families, series, status as active or backup vehicle. The companies must also identify out of which terminal the vehicles potentially receiving Carl Moyer Program funds operate.

- New purchase, repower, and retrofit projects for group 2a (MY 1960-1987 with a total fleet of $\geq$ 15 collection vehicles) are eligible for funding through December 31, 2006 if the following are met:

  – 100 percent of the vehicles in group 2a must be in compliance with the SWCV ATCM and in operation by December 31, 2006.

  – 25 percent of the vehicles in group 2a would be eligible for the incremental cost of the new purchase, repower or retrofit project up to the weighted cost-effectiveness limit.

  – The maximum project life for these projects is three years.

- New purchase, repower, and retrofit projects for group 2b (MY 1960-1987 with a total fleet of < 15 collection vehicles) are eligible for funding through December 31, 2007 if one of the following options are met:

  – If 100 percent of the vehicles in group 2b are in compliance with the SWCV ATCM and in operation by December 31, 2006, 50 percent of the vehicles in group 2b would be eligible for the incremental cost of the new purchase, repower or retrofit project up to the weighted cost-effectiveness limit. The project life for 25 percent of the vehicles is three years and the remaining 25 percent is four years.

  – If 100 percent of the vehicles in group 2b are in compliance with the SWCV ATCM and in operation by December 31, 2007, 25 percent of the vehicles in group 2b would be eligible for the incremental cost of the new purchase, repower or retrofit project up to the weighted cost-effectiveness limit. The project life for these vehicles is three years.

- New purchase, repower, and retrofit projects for group 3 (MY 2003-2006) are eligible for funding through December 31, 2007 if one of the following options are met:
  – If 100 percent of the vehicles in group 3 are in compliance with the SWCV ATCM and in operation by December 31, 2006, 100 percent of the vehicles in group 3 would be eligible for the incremental cost of the new purchase, repower or retrofit project up to the weighted cost-effectiveness limit. The project life for 50 percent of the vehicles is three years and the remaining 50 percent is four years.

  – If 100 percent of the vehicles in group 3 are in compliance with the SWCV ATCM and in operation by December 31, 2007, 50 percent of the vehicles in group 3 would be eligible for the incremental cost of the new purchase, repower or retrofit project up to the weighted cost-effectiveness limit. The project life for these vehicles is three years.

- During 2007-2009, new vehicle purchases throughout the state must meet the new vehicle purchase requirements above and must be certified to 0.2 g/bhp-hr for NOx.

- Surplus NOx reductions from retrofit projects are eligible for funding as described in the retrofit criteria above.

N. Street Sweepers and Other Stop-and-Go Vehicles

Stop-and-go vehicles, such as street sweepers, may be included in the public fleet rule scheduled to be considered by the Board in December 2005. This may affect the project criteria for these projects.

- Street sweeper projects that are surplus to regulations are eligible for funding for new purchase, repower, and retrofit projects. See the general program criteria listed above.

O. Transit Fleet Vehicles (Non-Urban Buses and Transit Vehicles)

Transit fleets include commuter service buses and or transit fleet vehicles that are not urban buses. These fleets are subject to a statewide in-use fleet rule that impacts vehicles with a GVWR of 8,501 pounds or greater and are powered by a heavy-duty engine fueled by diesel or alternative fuel that are owned or operated by a transit agency.

- Projects are subject to the general program criteria listed above.

- Projects will be considered on a case-by-case basis. All project applicants must submit evidence of compliance with the Transit Fleet Rule or documentation to show that the funds will not be used to meet the rule's requirements. Documentation must include the transit agency's Transportation Implementation Plan and annual ARB updates. If data included in the Transportation Implementation Plan is not sufficient, districts and/or ARB may require additional documentation.

- Through 2006, new vehicle purchases by transit agencies are eligible for Carl Moyer Program funding if the engine is certified to the optional standard of 1.8 g/bhp-hr NOx + NMHC.

- From 2007 to 2009, new vehicle purchases must be certified to 0.2 g/bhp-hr NOx to be eligible for Carl Moyer Program funding.

- Transit agency fleets established before January 1, 2007 are eligible for Carl Moyer Program funds for repower and retrofit projects if documentation is provided that shows:
  1. The whole fleet has met the 2.4 g/bhp-hr NOx fleet average, and

2. PM reductions of 80 percent compared to January 1, 2005 PM levels or equal to 0.01 g/bhp-hr times the total number of transit fleet vehicles in the current fleet whichever is greater.

- Transit agency fleets established after January 1, 2007 are eligible for Carl Moyer Program funds for repower and retrofit projects through December 31, 2007 if documentation is provided that shows:
  1. The whole fleet has met the 2.4 g/bhp-hr NOx fleet average, and
  2. PM reductions of 50 percent compared to the fleet's baseline when established.

- Transit agency fleets established after January 1, 2007 are eligible for Carl Moyer Program funds for repower and retrofit projects beginning January 1, 2008 if documentation is provided that shows:
  1. The whole fleet has met the 2.4 g/bhp-hr NOx fleet average, and
  2. PM reductions of 80 percent compared to the fleet's baseline when established.

P. Urban Transit Buses

An urban transit bus is a passenger-carrying vehicle powered by a heavy heavy-duty diesel engine with a load capacity of fifteen or more passengers and intended primarily for intra-city operation, short rides and frequent stops. Urban transit buses statewide are subject to an in-use and new purchase regulation that requires transit agencies that own, operate or lease urban buses to choose a diesel-fuel or alternative-fuel path and follow the requirements as described for each fuel path.

- Projects are subject to the general program criteria listed above.

- Projects will be considered on a case-by-case basis. All urban bus projects must submit evidence of compliance with the Public Transit Agency Vehicle Rule or documentation to show that the funds will not be used to meet the rule's requirements. Documentation must include the transit agency's Transportation Implementation Plan and annual ARB updates. If data included in the Transportation Implementation Plan is not sufficient, district and/or ARB may require additional documentation.

- For urban bus new vehicle projects, only the portion not funded by the Federal Transit Administration (FTA) is eligible for Carl Moyer Program funding. Proper documentation must be provided. The full incremental cost for an urban transit bus that is not funded by FTA may be granted under the Carl Moyer Program. Operation and maintenance costs are not eligible for Carl Moyer Program funding.

- Through 2006, alternative fuel buses are eligible for Carl Moyer Program funds for new bus purchases if the engine is certified to at least the optional standard of 1.8 g/bhp-hr for NOx + NMHC.

- Through 2006, diesel fuel buses are eligible for Carl Moyer Program funds for new bus purchases if the engine is certified to 0.2 g/bhp-hr for NOx.

- Urban bus fleets established before January 1, 2005 that are on the diesel fuel-path are eligible for Carl Moyer Program funds for repower and retrofit projects if documentation is provided that shows:
  1. The whole fleet has met the 4.8 g/bhp-hr NOx average, and
  2. PM reductions of 85 percent compared to January 1, 2002 PM levels or equal to 0.01 g/bhp-hr times the total number of current diesel-fueled active fleet buses whichever is greater.

- Urban bus fleets established before January 1, 2005 that are on the alternative fuel-path are eligible for Carl Moyer Program funds for repower and retrofit projects if documentation is provided that shows:
  1. The whole fleet has met the 4.8 g/bhp-hr NOx average, and
  2. PM reductions of 60 percent compared to January 1, 2002 PM levels.

- Urban bus fleets established after January 1, 2005 are eligible for Carl Moyer Program funds for repower and retrofit projects if documentation is provided that shows:
  1. The whole fleet has met the 4.0 g/bhp-hr NOx average, and
  2. May not have a diesel PM emission total exceeding 0.01 g/bhp-hr (exhaust emission value) times the total number of diesel-fueled buses in the active fleet.

- Hybrid electric bus (HEB) new purchases will be considered on a case-by-case basis, if the HEB is certified to the current NOx and PM standards.

VI. Cost-Effectiveness Calculations

To receive Carl Moyer Program funding, each project must meet the maximum cost-effective threshold of $14,300 per weighted ton of covered pollutants reduced. Only funds provided by the Carl Moyer Program and local district matching funds are to be used in determining cost-effectiveness.

The emission factors in the tables of Appendix B reflect preliminary data developed by ARB staff as part of a comprehensive effort to update the emissions models used for on-road motor vehicles and off-road mobile sources. These draft data were made available on ARB's website in early 2005, but are subject to change as staff completes its analyses and the associated model development. Appropriate emission factors as a function of vehicle type and model year are illustrated in Appendix B. ARB staff will issue Carl Moyer Program Advisories to update the tables as necessary.

The converted emission standards used in the calculations are the standards described in the emission standard section of this chapter that have been adjusted using the fuel correction factors and NOx fraction factors in Appendix B. It is important to note that urban buses have different standards than other heavy-duty vehicles.

Examples

On-road project calculations are generally mileage based. However, some projects such as stop-and-go vehicles can use fuel-based calculations.

For new purchase projects, the baseline will be an engine certified to the current standard. The reduced technology will be an engine certified to the current optional standard or 30 percent less than the current standard. For repower projects, the baseline will be the model year of the existing engine that would have been rebuilt. The reduced technology will be the engine certified to at least 5.0 g/bhp-hr of NOx that will be installed instead of the rebuilt engine. The baseline for a retrofit project is the existing engine. The reduced technology is the verified level of emission reductions for the retrofit.

A detailed description of how to calculate cost-effectiveness can be found in Appendices C and D.

VII. Minimum Project Application Requirements

A. Application

The applicant must provide the minimum information listed in Table 1-6.

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

Table 1-6
Minimum Application Requirements for On-Road Heavy-Duty Vehicle Projects

Air District Applicant Demographics Company Name: Business Type: Contact Name and Title: Mailing Address: Location Address: Contact Number: Project Description Project Name Project Location VIN or Serial Number Vehicle Function Vehicle Class GVWR(lbs): Annual Miles Traveled or Annual Fuel Usage Percent Operated in California Project Life (years) Application Type: (Repower, Retrofit or New) Existing Engine Information Serial number Engine Make Engine Model Engine Year Fuel Type	Replacement/New Engine Information Serial number Engine Make Engine Model Engine Year Fuel Type Certification Executive Order Retrofit Technology Product Name Executive Order Reference Cost-Effectiveness Analysis Basis (choose one) Annual Mileage Annual Gallons Incremental Cost Repower Cost ($) of the existing engine (rebuild cost) Cost ($) of certified replacement engine New Purchase Cost ($) of the required certified engine Cost ($) of certified lower emission engine Retrofit Cost ($) of retrofit kit Dollar amount of additional financial incentives District Incentive Amount Requested

B. Reporting and Monitoring

Reporting and monitoring requirements for districts are described in the Administrative Chapter of these Guidelines.

Fleet operators and transit agencies participating in the Carl Moyer Program are required to keep appropriate records during the life of the funded project as determined by the district and ARB. Records must contain, at a minimum, total miles traveled in and outside of California, fuel usage, and maintenance and repair information. Records must be retained and updated throughout the project life and made available at the request of the district or ARB.

VIII. References

ARB, 2002a. Air Resources Board. December 12, 2002. California Exhaust Emission Standards and Test Procedures for 1985 through 2003 Model Heavy-Duty Diesel Engines and Vehicles. http://www.arb.ca.gov/msprog/onroadhd/85-03hddtps_levhdg02_clean_11-14.doc

ARB, 2002b. Air Resources Board. December 12, 2002. California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles. http://www.arb.ca.gov/msprog/onroadhd/2004hddtps_levhdg02_clean_11-13.doc

ARB, 2004. Air Resources Board. June 4, 2004. Diesel Particulate Matter Control Measure for On-road Heavy-duty Diesel-fueled Residential and Commercial Sold Waste Collection Vehicles. http://www.arb.ca.gov/regact/dieselswcv/fro2.doc

ARB, 2005. Air Resources Board. January 7, 2005. Staff Report: Proposed Modifications to the Fleet Rule for the Transit Agencies and New Requirements for Transit Fleet Vehicles. http://www.arb.ca.gov/regact/bus04/isor.pdf

Chapter Two

HEAVY-DUTY ON-ROAD FLEET MODERNIZATION

This chapter adds a fleet modernization source category to the Carl Moyer Program. Fleet modernization provides incentives to replace old high-polluting heavy-duty vehicles with newer, lower emission replacement vehicles. The fleet modernization source category provides real emission benefits by retiring the high polluting vehicle earlier than would have been expected through normal attrition. Carl Moyer Program funds for fleet modernization projects are used to offset part of the cost of the replacement vehicle. Project funds also pay for a diesel particulate emission reduction device to further reduce emissions and an electronic monitoring unit to verify miles traveled in California and the district. An additional vehicle replacement strategy included in fleet modernization is the tiered transaction. A tiered transaction project combines the purchase of a new vehicle certified to the optional NOx standard by one owner with the replacement of an old vehicle by a second owner.

I. Introduction

Heavy-duty diesel trucks are durable and stay in operation for an average of 18.5 years. Old trucks contribute disproportionately to the state's NOx, ROG, and PM10 emissions. Pre-1990 heavy-duty trucks emit one and a half times as much NOx and two and a half times as much PM10 as a truck that meets current standards. These old trucks tend to be driven by relatively low-income operators and are concentrated in specific industrial sectors. Generally, the income generated from the old trucks operating in low paid vocations does not justify the purchase of a newer truck, even with the improved fuel economy, reduced maintenance costs, and fewer downtime expenses of a newer truck. These old trucks continue operating until they deteriorate to a point that it does not make economic sense to repair them.

The Carl Moyer Program for on-road vehicles was designed to pay for the incremental purchase cost of a new vehicle that is cleaner than the required emission standards. However, the owners of the oldest trucks cannot afford to buy a new vehicle that qualifies for incentive funds. It is unlikely that the old truck owners would be willing to invest in a newer truck since the old truck is still operating. In addition, operators of old trucks do not have an incentive to sell their trucks since the market price for the old trucks is undervalued relative to its utility to the truck owner. Traditional scrap programs, which provide incentives to scrap a vehicle, may not lower emissions from the old, heavy-duty sector because the old, scrapped truck is likely to be replaced with another affordable old truck.

Recognizing that resources were not available to get old, high polluting vehicles off the road, AB 1394 was passed in 2004 directing ARB to consider fleet modernization as a potential project under the Carl Moyer Program. As such, the Air Resources Board (ARB or Board) is proposing a source category that provides incentive funds to replace old vehicles that were unlikely to be removed from operation with newer, cleaner vehicles. The incentives provided by the Carl Moyer Program change the economics of

vehicle replacement, making it economically feasible for owners who could not previously justify the expense.

II. Emissions

According to ARB's motor vehicle inventory, 1990 and older vehicles account for 33 percent of California's heavy-duty fleet. This equates to about 58,800 pre-1991 and older heavy-duty vehicles traveling over four million miles per day statewide. In 2005, these vehicles will emit about 107 tons of NOx and three tons of PM10 per day, as reflected in Table 2-1. The number of these old trucks will decrease to slightly over 32,000 by 2010, but this gradual decline is not sufficient if California is to achieve its air quality goals. This is of particular concern because emissions from older trucks often occur in environmental justice areas, such as ports, which are heavily impacted by high volumes of truck traffic.

Table 2-1
Statewide Calendar Year 2005
Contribution of Pollutants by On-Road Heavy-Duty Vehicles
1990 Model Year and Older*

	Population	NOx	ROG	PM10
2005	58,775	107	6	3
2010	32,155	43	3	1

*EMFAC2002 v2.2 (April 03)

Using data from the United States Census Bureau 2002 Economic Census - Vehicles and Use Survey [U.S. Census Use Survey], ARB staff determined that in California there are specific industrial sectors that have the highest concentration of old vehicles. Most significant to the fleet modernization category are the vocations with the highest numbers of 1990 and older trucks in service. Approximately 60 percent of the mining fleet is 1990 and older; 55 percent of the trucks engaged in agriculture and forestry are 1990 and older; and, 43 percent of the construction fleet is 1990 and older. In addition to these fleets, it is widely recognized that haulers moving goods from California's ports and rail yards utilize the oldest trucks in the fleet.

The concentration of old trucks in specific vocations generally occurs through a series of sales of the individual trucks. Trends in the industry show that fleets which normally utilize new trucks turn over their trucks in three to five years. The vehicles are then sold to operators that drive high mileage in a well-paid vocation. After several years of use, the vehicle is sold again, moved into a low-paid, low-mileage sector and driven until it deteriorates to the point where it does not make economic sense to repair it. The owners of the oldest vehicles tend to buy another old vehicle to replace the truck that has deteriorated, and do not normally purchase a new or newer vehicle. Data from the U.S. Census Use Survey supports this claim: four out of five newer trucks (<5 years old) are purchased as new vehicles, while four out of five old trucks (>15 years old) are purchased as used vehicles.

III. Regulatory Requirements

To help meet California's air quality goals, the ARB has adopted engine emission standards and several mobile source fleet regulations that apply to on-road trucks. In addition, ARB is currently drafting regulations that will be considered by the Board in late 2005 and 2006. Recently adopted regulations demonstrate the Board's increased commitment to reduce emissions from the in-use fleet. The standards and regulations, which may impact eligibility for all heavy-duty, on-road projects, including fleet modernization, are included in Chapter One. All Carl Moyer Program project emission reductions must be surplus to regulatory requirements. Applicants from fleet categories must be especially cognizant of the impact of recently adopted and upcoming requirements, such as solid waste collection vehicles and public and utility fleets.

Public and private, on-road, heavy-duty, diesel-fueled vehicle fleets, such as in-use heavy-duty trucks, are not currently regulated. The Board will hear a proposed diesel particulate control measure for private fleets in 2006, which may further impact the project criteria for these projects.

Fleet modernization incentives may be used for the purchase of a new vehicle. For standard fleet modernization projects that replace an old vehicle with a new vehicle, the new vehicle must be certified to more stringent emission standards than the vehicle being replaced. With tiered transaction projects, the new vehicle must be certified to ARB's current optional NOx emission standards of 1.8 grams per brake horsepower-hour (g/bhp-hr) of NOx through 2006, regardless of fuel type or engine design. Beginning in 2007, the optional standards will sunset and projects for new vehicle/engine must be certified to 0.2 g/bhp-hr of NOx. Since new engines are certified throughout the year, districts are encouraged to contact ARB for the most current list of eligible engines.

IV. Development of the Fleet Modernization Source Category

The ARB has long recognized the need to reduce emissions from the oldest trucks in the heavy-duty diesel truck sector. In 1994, the ARB proposed a concept for retiring heavy-duty vehicles in its State Implementation Plan for Ozone as Measure M-7. The measure envisioned the program could be self-sustaining through the sale of the old trucks for export to overseas markets. However, the M-7 measure was eventually withdrawn because of concern regarding the lack of funding and analyses showing that the old, high emitting trucks removed from the fleet were likely to be replaced with similar aged trucks from outside the area.

In 2001, the Sacramento Metropolitan Air Quality Management District (SMAQMD) received ARB's approval to establish a fleet modernization pilot program, which was funded by the Sacramento Emergency Clean Air Transportation program in partnership with the Sacramento Area Council of Governments (SACOG). The Sacramento program was designed to replace the oldest trucks in a fleet by scrapping the trucks and providing a monetary incentive to purchase newer trucks with fewer emissions. The SMAQMD developed the concept as an alternative to on-road repower projects. Also in

2001, the Gateway Cities Coalition of Governments, located in the area surrounding the Port of Long Beach, initiated a fleet modernization program that mirrored the Sacramento program. To ensure that incentives were changing the normal purchase practices of operators with the oldest trucks, both pilot programs required the destruction of the old truck and a commitment to keep the replacement vehicle in the same location doing the same type of work. These requirements aimed to resolve the concerns raised in response to the original M-7 measure.

A. Sacramento Metropolitan Air Quality Management District Program

The SMAQMD in partnership with SACOG administers a fleet modernization program for the Sacramento and surrounding air districts. This region includes El Dorado, Placer, Sacramento, Solano and Yolo counties. The SMAQMD pilot program was implemented in 2002 with the expectation that data would be gathered on the replacement vehicles for five years. To date, the SMAQMD program has appropriated approximately $10 million to replace 300 trucks. The average incentive award for the program is $35,000 with a cost-effectiveness of $8,000/ton of NOx reduced. It is estimated that the SMAQMD program has reduced 200 tons of NOx and 30 tons of PM10 per year. The replaced vehicles come primarily from construction and heavy-hauling vocations.

B. Gateway Cities Council of Governments Program

The Gateway Cities Council of Governments (COG) administers a program in the region surrounding the Port of Long Beach and the Port of Los Angeles. The COG is a joint powers authority whose members are the 27 cities in southeast Los Angeles County and the Port of Long Beach. The COG program has expended approximately $7.6 million on the replacement of 350 trucks. The average incentive award for the program is $25,000 with a cost-effectiveness of $8,400/ton of NOx reduced. It is estimated that the COG program has reduced 193 tons of NOx and 42 tons of PM10 per year. The replacement vehicles are owned primarily by independent operators working in port related vocations. The Gateway vehicles tend to be older and have lower mileage than the Sacramento program. Approximately 85 percent of the program participants are non-English speaking. The Gateway Cities program has received funding from multiple sources including the ARB, the United States Environmental Protection Agency (U.S. EPA), the Mobile Source Air Pollution Reduction Review Committee, and the Port of Los Angeles.

C. Lessons Learned

In developing the proposed criteria for the heavy-duty fleet modernization source category, ARB staff, in collaboration with a multi-agency workgroup, established parameters based on the legislative guidance and mandates, data from existing federal and state emission inventories, and data and expertise gathered from the pilot programs. This information has been instrumental in the development of project criteria for a robust, statewide program. To insure real emission reductions, the proposed criteria includes requirements that assure the newly-funded truck will have the same

configuration as the old truck, that it will stay in the same vocation and not move to a new location, and that the greatest emission reductions are realized through the use of diesel emission reduction devices. Staff is also proposing rigorous qualifying criteria to assure that the replaced vehicle would have been operating for the project life and that the heavy-duty fleet modernization participants would have been unlikely to have replaced their old truck with a newer truck without incentive funds. The fulfillment of contract obligations is addressed through the use of electronic monitoring devices and monitoring and reporting requirements.

V. Key Components of the Fleet Modernization Source Category

Ensuring that the emission reductions from an incentive program are real, quantifiable, enforceable, and surplus, is critical to the success of the Carl Moyer Program. Given the new niche that fleet modernization must serve, new and rigorous criteria have been proposed to protect the integrity of the program. The major proposed criteria include: eligibility of the old vehicle, vocations, model years, project life, weight class, salvage requirements, electronic monitoring units, funding caps, subtracting the cost of repairs, tiered transactions, and administrative tools.

A. Eligibility of the Old Vehicle and Replacement Vehicle

To receive funding for fleet modernization projects, participants must show that the old vehicle meets the following requirements: it must be a model year 1990 or older; it must have California registration for the last three years; the participant must show proof of ownership, vocation, operation, and documentation to verify actual mileage; and the old vehicle must be turned over to an approved salvage yard for destruction, this includes requiring the engine be destroyed and the frame rails cut. The replacement vehicle must be model year 1999 or newer and it must be identical to the old vehicle including axle configuration and body type to prevent a change in vocation during the life of the project. New vehicles participating in tiered transaction projects are required to meet the optional NOx standard.

B. Vocations

One of the goals of the fleet modernization is to ensure that participants continue to do the same type of work and do not drift to other vocations once they have acquired a newer vehicle that is capable of traveling long distances with greater reliability. This restriction is necessary because the movement of a fleet modernization truck to a new vocation would result in another old truck backfilling the original vocation. The program requires participants to show proof of vocation for the previous three years and maintain that vocation for the life of the project.

Vocation is further emphasized by providing greater incentives to vehicles operating in vocations known to have the highest number of old trucks in service. Targeted vocations include vehicles operating in agricultural, construction, mining, forestry vocations, and vehicles that move goods in and out of ports and rail yards. Participants

from the targeted vocation are eligible for a five year project life, rather than the standard three year project life available for other types of vocations.

C. Model Years

To be eligible for the fleet modernization source category, the old vehicle must be a model year 1990 or older. This model year was selected for several reasons. The emission factors for the 1990 and older vehicle make it a high emitting vehicle at 21.2 grams of NOx/mile and 1.32 grams of PM/mile. The EMFAC 2002 inventory shows that there are approximately 58,000 of these old vehicles on the road today. Reducing the number of these high emitting vehicles will improve air quality. The SMAQMD pilot program originally allowed only 1983 and older vehicles to participate in its program. The district then modified its pilot program to allow 1986 and older vehicles. Recently, the district moved the eligible model year to 1990 and older vehicles because it has exhausted the number of available applicants with 1986 and older vehicles. Districts should consider a similar strategy when establishing a fleet modernization category- initially targeting the very oldest trucks and then moving up the allowable age as the program progresses.

Under fleet modernization, the replacement vehicle must be model year 1999 or newer. A 1999 model year was selected due to reduced emission factors, concern with consent decree engines, and affordability to participants. Dual-calibration engines manufactured from 1993-1998 are bound by ARB and U.S. EPA consent degrees and are not eligible for Carl Moyer Program funding. Districts will need to verify the engine model year for 1999 model year vehicles because 1998 model year engines may have been installed and are not eligible for funding. Experience with the Gateway COG pilot program shows that a majority of their fleet modernization participants purchased 1999 model year replacement trucks. 1999 is a popular choice because it is generally the least expensive model qualified for fleet modernization funding. Selecting a newer, more expensive model year would make the fleet modernization inaccessible to program participants that are from low-paid vocations.

D. Project Life

The project life for fleet modernization projects, with the exception of target vocations, is three-years. A three-year project life was selected because inventory data show the life expectancy of a 1990 on-road, heavy-duty vehicle that is still on the road is an additional 5.5 years. This means that 50 percent of the heavy-duty fleet 15 years and older would remain on the road for another 5.5 years on average, while the other 50 percent would retire through attrition. It is expected that the old trucks volunteered for a fleet modernization project will be those with less remaining life. To be protective of air quality and ensure that real emission reductions are achieved, staff is proposing three years as an acceptable project life. This approach follows what has already been established in the existing regulations for the Voluntary Accelerated Light-Duty Vehicle Retirement Program. The light-duty program is designed to retire very old light-duty vehicles. In that program the life expectancy was reduced by 50 percent to determine the credit value.

Targeted vocations are allowed a five-year project life because they are known to keep the oldest vehicles in service for more years and would be less likely to replace their trucks with a newer truck than the average old truck owner. Data indicate that in these very limited target vocations, the normal practice for purchasing vehicles is to purchase vehicles of the same age or older. Staff proposes that for these vocations, the data justifies allowing a five-year project life.

E. Weight Class

The focus of the fleet modernization pilot programs has been the replacement of heavy heavy-duty trucks with all analysis conducted on the heaviest class of vehicles. Fleet modernization projects will continue to focus on vehicles having a gross vehicle weight rating of 33,000 pounds and greater. However, some districts have expressed an interest in including vehicles in the medium heavy-duty class. Districts may request inclusion of medium heavy-duty vehicles with a weight class rating of 19,501-33,000 pounds on a case-by-case basis.

F. Salvage Requirements

Fleet modernization requires that the old truck be scrapped. To ensure that the vehicle will not be used again, the criteria specify that a qualified salvage yard must drill a hole in the engine block and cut the frame rails of the old vehicle. This requirement has been established to ensure that emission reductions are real. It prevents the old trucks from being moved into another locale to continue emitting high levels of pollutants.

G. Electronic Monitoring Units

All fleet modernization replacement vehicles must be equipped with an electronic monitoring unit (EMU). The EMU electronically reports vehicle miles traveled and the number of miles a vehicle has operated within California and district boundaries. This requirement has been established to verify that the replacement vehicle continues to operate in the same location as the old, scrapped vehicle. The ARB is developing a state services master agreement to assist local air districts and to streamline the local contracting process for EMUs.

H. Funding Caps

The fleet modernization criteria sets a maximum funding amount of 72 percent of the value of a used, replacement vehicle and 80 percent of the invoice price of a new vehicle. These caps are based on the maximum loan value available through lending institutions.

I. Subtracting the Cost of Repairs

Fleet modernization projects are required to subtract the cost of repairs needed for the old vehicle from the incremental cost of the project. The cost of repairs is subtracted

because it is assumed that repair costs are a normal business expense that would have been incurred by the participant had the vehicle stayed in service. The repair costs are identified during the inspection verifying the operating condition of the old vehicle.

J. Tiered Transactions

Tiered transactions are an additional vehicle replacement strategy available through fleet modernization. A tiered transaction combines the emission reductions achieved from the purchase of a new vehicle meeting the optional NOx standard with a basic fleet modernization project. Combining both transactions provides additional incentives to offset the cost of purchasing the vehicle meeting the optional standard. However, linking the purchase of the new vehicle by one owner, with the retirement of an old truck and purchase of a replacement truck by a second participant, presents complexities that are not found in the basic fleet modernization transaction. Tiered transactions are a new concept enacted by legislation and have not been included in the pilot programs. Local air districts may develop and implement tiered transactions as part of their fleet modernization component. ARB must approve a district's proposed tiered transaction component prior to implementation.

K. Administrative Tools

The ARB must review and approve local air district fleet modernization guidelines prior to the district funding fleet modernization projects. This requirement has been established because both pilot programs show there are many administrative tools needed to implement fleet modernization. These include: contracts with the applicant, dealers and scrap yards; performance requirements; reimbursement procedures; pre- and post-inspections; and, monitoring and enforcement considerations. This requirement will help achieve ARB's goal of establishing a robust, verifiable, enforceable fleet modernization component that reaches previously non-eligible sectors. As with all Carl Moyer Program components, districts are provided with outreach funds, which are approximately two percent of the Carl Moyer Program grant. In addition, there are a number of funding sources districts may use to cover in-kind costs. When using these other funding sources, districts must follow the guidelines for expending those other funds.

VI. Potential Projects

As discussed, there are two types of potential projects available under the fleet modernization category. The first is the replacement of an old vehicle (1990 or older) with the new or newer vehicle (1999 or newer). The second type of project is a tiered transaction, which links the emission reductions achieved from the purchase of a new vehicle meeting the optional NOx standard with the retirement of an old vehicle (1990 and older). Under the tiered transaction project, two transactions take place:

- A participant proposes the purchase of a new vehicle meeting the optional NOx standard and estimates the cost of this transaction based on a new, heavy duty vehicle purchase (as discussed in Chapter One, Section V-C).

- This same owner identifies a standard fleet modernization project that meets the fleet modernization criteria and estimates the cost-effectiveness of the project.

- The combined cost-effectiveness of both transactions is used to determine cost-effectiveness.

Tiered transactions could potentially be utilized by one party that purchases new equipment meeting the optional standard and contributes replacement vehicles to a fleet that has old vehicles.

In addition to replacing an old, high-emitting vehicle with a newer, cleaner vehicle, fleet modernization requires the use of diesel emission control strategy (DECS) on all projects. An ARB-verified DECS is required on all fleet modernization vehicles. In selecting the appropriate DECS for the project, preference is given to the device providing the highest level of emission reductions. Examples of DECS include diesel particulate filters, diesel oxidation catalysts, and flow through filters. Incentive funds may be used to cover the cost of DECS maintenance and filters needed for the duration of the project life.

The requirement for a DECS may be waived. The waiver must be based upon the specifics of individual projects including cost, vehicle duty cycle restrictions, availability, and other factors. Additional details regarding the DECS requirement, including funding and data logging options, are included in Section VII-C.

VII. Proposed Project Criteria

Fleet modernization projects, which include scrapping an old, high-emitting vehicle and replacing it with a newer, cleaner vehicle, are eligible for incentive funding. The proposed project criteria listed below provide the minimum qualifications for the Carl Moyer Program. Sample calculations that illustrate the methodology for determining emission reductions and cost-effectiveness are included in Appendix D.

Participating districts retain the authority to impose additional requirements in order to address local concerns.

A. General Criteria

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding with a regulatory agency, settlement agreement, mitigation requirement, or other legal mandate.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits or to offset any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging banking and trading program.

- In funding fleet modernization projects, the replacement vehicle must reduce NOx emissions by at least 15 percent from the old vehicle emissions.

- Carl Moyer Program grants can be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including tax credits or deductions, grants, or other public financial assistance.

- Fleet modernization projects have a minimum project life of three years. Project life is the number of years that a Carl Moyer Program project must operate in California under the conditions specified in the grant funding agreement.

- The default project life does not consider upcoming regulatory requirements. Project life may be shorter due to regulatory requirements.

- Fleet operators with vehicles in open vocation categories are eligible to receive funding for a maximum of five vehicles. There is no restriction on the number of vehicles per fleet that can be funded in targeted vocation categories.

- Fleet modernization project life must be equal to the project contract life.

- Vehicles equipped with glider kits are not eligible to participate in the fleet modernization category; this includes both old and replacement vehicles. Glider kits are replacement chassis and cab for on-road heavy-duty vehicles. Glider kits are identified with a vehicle identification number (VIN) starting with the letters "GL".

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the air district suggests potential surplus, real, quantifiable and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on a case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

B. Participant Requirements

The following categories of vehicles are eligible for Carl Moyer Program funding:

- **Open Category**: Vehicles from any vocation or fleet size are eligible for funding provided the participant submits conclusive documentation of annual mileage and vehicle usage in California. The maximum project life is three years.

- **Targeted Vocation Category**: Vehicles operating in agricultural, construction, mining, port hauling, and forestry vocations, or vehicles that move goods in and out of ports and rail yards may apply as a targeted vocation. The participant is required to submit conclusive documentation of annual mileage and vehicle usage in California. The maximum project life is five years.

- The old vehicle must have both engine and chassis of model year 1990 or older.

- The old vehicle must have been registered in California for the previous three years.

- The old vehicle must be in operational condition to qualify for funding. Operating condition must be determined through a California Highway Patrol's Biennial Inspection of Terminals (CHP BIT) or equivalent inspection. The inspection must identify any needed repairs and the estimated cost of the repairs. The district will also verify the operating condition of the truck by a visual and operational inspection. If the district cannot conduct a pre-inspection, the ARB may approve one of the following methods on a case-by-case basis:

  – The motor carrier company may submit a completed CHP 90-Day Safety Inspection Form documenting their inspection and the estimated cost of any repairs.

  – A participating dealership or motor company may conduct the inspection of the old vehicle and provide pictures verifying the vehicle condition. The dealer must provide a completed CHP 90-Day Safety Inspection Form and documentation of any necessary repairs. The participant will pay the cost of the inspection.

  – Other methods as approved by ARB.

- The participant must currently own and operate the old vehicle. If it is unclear whether a vehicle is owned or leased by a participant, the district will determine whether the vehicle is eligible.

- Participants must submit documentation of annual miles traveled for the previous three years to determine cost-effectiveness. Examples of documentation include: logbooks; fuel records; and/or maintenance records.

- The participant must maintain replacement value insurance coverage for the project life.

- The participant must be in compliance with air quality laws; all outstanding citations must be paid up.

C. Replacement Vehicle Requirements

All replacement vehicles must meet the following conditions before funding is awarded to the participant.

- Model Year: The replacement vehicle must have both an engine and chassis model year of 1999 and newer.

- The replacement vehicle must operate in the same vocation for the project life. The participant must stay in the contracted vocation for a minimum of 85 percent of the miles, as specified in the application. If a change of vocation is required to stay in operation, a written explanation must be provided to the district and approved by the ARB.

- The annual mileage of the replacement vehicle must not exceed 150 percent of the baseline project mileage, except as approved by the district and ARB.

- Engine Horsepower Requirements: The horsepower rating for the replacement vehicle engine must not be greater than 120 percent of the original manufacturer rated horsepower (baseline horsepower) for the old vehicle engine. This is necessary because engine horsepower is related to the emissions produced by heavy-duty diesel engines. Auditing of the replacement vehicle's horsepower may occur throughout the length of the agreement.

  – Participants must use the horsepower rating listed on the old engine tag. If the engine tag is not legible, a dynamometer test can be used to determine the horsepower rating. The results of a dynamometer test will take into account a 15 percent loss in actual horsepower, based on transmission loss. The participant must pay the cost of dynamometer testing.

  – In the event the replacement engine horsepower is more than 20 percent greater than the old vehicle, it must be derated (reduced) to not exceed the 20 percent allowable increase. The 20 percent allowable increase in horsepower is calculated as follows:

    (Old Engine Horsepower) x (1.20) = Maximum New Engine Horsepower
    (Example: 300 HP x 1.20 = 360 HP)

  – In limited situations, the district may approve a greater than 20 percent increase in horsepower.

- Weight Class: Eligible vehicles must have a California heavy-heavy gross vehicle weight rating of 33,000 pounds. Vehicles having a California medium heavy-duty weight rating of 19,501-33,000 pounds may be eligible upon the request of the district on a case-by-case basis. The replacement vehicle must be in the same weight rating as the old vehicle.

- Body and Axle Configuration: The replacement vehicle must have the same axle and body configuration as the old vehicle. The district may allow slight changes based on the latest technology. Changes must be requested and approved prior to the purchase of the replacement vehicle.

- Warranty Requirements: All participants must purchase a minimum of a one-year or 100,000-mile major component engine warranty for the replacement vehicle. The warranty must cover parts and labor. It is recommended that the highest grade warranty be purchased in order to avoid expensive repairs in the future. No Carl Moyer funds will be issued for maintenance or repairs related to the operation of the vehicle. The participant takes sole responsibility for ensuring that the vehicle is in operational condition throughout the agreement period.

- ARB Verified Diesel Emission Control System (DECS): An ARB-verified DECS is required on all replacement vehicles.

  – In selecting the appropriate DECS for the project, preference shall be given to the DECS providing the highest level of NOx and PM10reductions.

  – The DECS must be installed prior to vehicle delivery to the participant and must stay in operation on the replacement vehicle for the project life.

  – The cost of the device, and all filters and maintenance of the filters needed during the project life, may be paid for with incentive funding provided it meets the cost-effectiveness limit.

  – Upon approval of the ARB, the district may waive the requirement for installation of the DECS. The waiver must be based upon the specifics of individual projects, including cost, vehicle duty cycle restrictions, availability, and other factors.

  – Data-logging may be conducted on the old vehicle to determine the proper DECS device needed for the replacement vehicle. Data-logging, which is the collection of exhaust temperatures, must be conducted while a vehicle is in service. The information gathered from the old vehicle is applied to the replacement vehicle. Data-logging may be paid for with incentive funding, if it meets the cost-effectiveness limit.

  – The participant must maintain the DECS as specified by the manufacturer's warranty requirements. The participant must provide maintenance reports to the district as required.

  – If an ARB-approved DECS is not available at the time the replacement vehicle is purchased, a DECS will be installed when a DECS compatible with the engine and the vehicle duty cycle has been verified by ARB, unless otherwise stipulated at the time of purchase by the district.

- Vehicles outfitted with dual exhaust will be addressed on a case-by-case basis. The district will determine if no DECS is required, or if a DECS shall be installed on both exhaust tailpipes, or if the exhaust shall be converted to a single pipe with a DECS.

- Additional information on retrofit systems is included in Appendix F - Retrofit Emission Control Systems.

- Electronic Monitoring Unit (EMU): The EMU electronically reports vehicle miles traveled and the number of miles a vehicle has operated within the California and district boundaries. An EMU is required on all replacement vehicles.

  - Installation and maintenance of the EMU may be included in the cost of the project.

  - If an affordable and suitable EMU is not available at the time the replacement vehicle is ready for delivery, the vehicle may be delivered to the applicant. The owner will be required to return the vehicle to the dealer when an EMU is available for installation. Verification of the installation must be submitted to the district following installation.

  - EMU data must be reported to the district for the project life.

  - If the EMU is not functioning properly as indicted by the district, the participant will submit mileage reports as specified the district.

  - Upon approval of the ARB, the district may waive the requirement for installation of an EMU.

- Engine and Emission Control Modifications: Emission controls on the replacement vehicle engine cannot be modified in any manner. Unauthorized modification to engine performance (including changes in horsepower), emission characteristics, engine emission components (not including repairs with like-original equipment manufacturers replacement parts), or any other modifications to the engine's emission control function or the EMU are not allowed.

D. Tiered Transactions

Districts may establish a tiered transaction component within their fleet modernization source category. Tiered transactions were added to the Carl Moyer Program with the enactment of AB 1394 in January 2005, but were not included in the fleet modernization pilot programs. As a result, there is no experience or model to guide districts in implementing a tiered transaction component. ARB must approve district plans for implementing a tiered transaction component prior to funding projects in this unmapped territory.

A tiered transaction combines the emission reductions achieved from the purchase of a new vehicle meeting the optional NOx standard with the replacement of a 1990 or older vehicle. In the tiered transaction, the purchaser of a new vehicle meeting the optional standard identifies a standard fleet modernization project that meets the fleet modernization criteria, including the participation of a 1999 or newer replacement vehicle. A second participant acquires the replacement vehicle and scraps a 1990 or older vehicle. Tiered transaction programs should include the following elements; however, districts may request that ARB consider alternative components.

- In determining the grant award for the purchaser of the new vehicle, the emission benefits and cost-effectiveness of the project must include two transactions:
  - Emission reductions from the currently applicable standard to the new vehicle meeting the optional standard.
  - Emission reductions from the old vehicle to the replacement vehicle.
- The baseline cost for the new vehicle purchase is the cost of a new vehicle that meets the current emission standards. The incremental cost eligible for funding is the cost of the vehicle meeting the optional standard minus cost of the vehicle meeting the existing standards. This is the standard method used for new, on-road Moyer projects.
  - Emission reductions from the old vehicle are based on the annual mileage traveled by the old vehicle.
  - The participant scrapping the old vehicle is subject to all fleet modernization project criteria. The participant purchasing the new vehicle is subject to all on-road, heavy-duty project criteria.
  - The participant purchasing the new vehicle is not eligible for emission reductions from scrapping an old vehicle within his/her own fleet.

VIII. Emission Reduction and Cost-Effectiveness Calculations

To receive weighted Carl Moyer Program funding, each fleet modernization project must meet the maximum cost-effectiveness threshold of $14,300 per weighted ton of NOx + ROG + PM10 reduced. State and local funds used to pay for a fleet modernization project are to be used in determining cost-effectiveness. Any federal incentives must be discounted from the overall grant award. Appropriate emission factors as a function of vehicle type and model year are illustrated in Tables B-5 in Appendix B. Sample calculations for the fleet modernization category are provided in Appendix D.

IX. Minimum Project Application Requirements

All fleet modernization applicants must provide the minimum information listed in the following table (Table 2-2).

Table 2-2
Minimum Application Requirements for Fleet Modernization

1. Air District

2. Applicant Information
   Company Name:
   Business Type:
   Contact Name and Title:
   Mailing Address:
   Location Address:
   Telephone Number:

3. Project Description
   Project Type: Fleet Modernization
   Applicant Name:
   Project Vocation
   Project Location:
   Vehicle Function:

4. Old Vehicle Information
   Engine Make:
   Engine Model:
   Engine Year:
   Horsepower Rating:
   Vehicle Class: GVWR (lbs):
   Annual Miles Traveled or
   Annual Fuel Usage:
   Fuel Type:
   Percent Operated in California:
   Project Life (years):

5. Replacement Vehicle Information
   VIN or Serial Number:
   Vehicle Make:
   Vehicle Model:
   Engine Make:
   Engine Model:
   Engine Year:
   Horsepower Rating:
   Vehicle Class: GVWR (lbs):
   Fuel Type:

6. For Tiered Transactions Only-
   New Optional Standard Vehicle
   VIN or Serial Number:
   Vehicle Make:
   Vehicle Model:
   Engine Make:
   Engine Model:
   Engine Year:
   Horsepower Rating:
   Vehicle Class: GVWR (lbs):
   Fuel Type:

7. Diesel Emission Control System Information
   Equipment Make:
   Equipment Model:
   Model Year:
   Level:
   Percent Reduction of NOx:
   Percent Reduction of PM:
   Verification Executive Order:

8. NOx Emissions Reductions
   Baseline NOx Emission Factor:
   NOx Conversion Factors Used:
   Reduced NOx Emissions Factor:
   Estimated Annual NOx Emissions Reductions:

9. Projected Annual Mileage or Fuel Usage:

10. Estimated Lifetime NOx Emissions Reductions:

11. PM10 Emissions Reductions
    Baseline PM10Emissions Factor:
    PM10Conversion Factors Used:
    Reduced PM10Emissions Factor:
    Estimated Annual PM10Emissions Reductions:

12. Estimated Lifetime PM10 Emissions Reductions:

13. ROG Emissions Reductions
    Baseline ROG Emissions Factor:
    ROG Conversion Factors Used:
    Reduced ROG Emissions Factor:
    Estimated Annual ROG Emission Reductions:

14. Estimated Lifetime NOx, ROG, and PM10 Emission Reductions:

15. Cost ($) of the Base Vehicle

16. Cost ($) of Replacement Vehicle

17. Cost ($) of DECS, includes data logging, installation and maintenance

18. Cost ($) of Electronic Monitoring Unit

19. Incremental Cost-Effectiveness Analysis Basis: (Mileage/Fuel/Hours of Operation)

20. District Incentive Amount Requested

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

In addition, the following items must accompany the completed application at the time of submittal:

- A copy of the old vehicle title.
- Copies of California Motor Carrier Permits and permit applications for the last three years. If the participant does not have a Motor Carrier Permit, submit copies of the Department of Motor Vehicle registration and proof of insurance for the old vehicle for the last three years.
- The participant must provide mileage verification for the previous three years.
- Proof of vehicle vocation for the last three years.
- The participant may be required to provide either:
  - Copies of the participant's United States Internal Revenue Service Form 2290 (Heavy Highway Vehicle Use Tax Return) for the previous three years.
  - United States Internal Revenue Service Schedule C.
- If the old vehicle engine tag is missing, the participant may be required to provide a dynamometer printout of the engine horsepower from a participating engine

dealership, or another means of obtaining the required information approved by the ARB.

- The district may request any additional information.

X. Administrative Requirements

Districts must establish fleet modernization policies and guidelines before they can fund fleet modernization projects. Many administrative tools are needed to manage a reliable fleet modernization source category. This includes agreements with local dealerships and salvage yards, reimbursement procedures, the development of contracts, etc. The ARB must approve district fleet modernization policies and guidelines prior to district implementation of a fleet modernization category. The ARB will provide examples for district use. The district's fleet modernization guidelines must address all of the above criteria as well as the items discussed in the following sections.

A. Determining Awards

Grant award determinations must be made with the following considerations:

- Funding awards are based on the average miles per year driven during the previous three years. Fleet averages can not be used. Participants must submit conclusive documentation of mileage including logbooks, fuel records, and maintenance records maintained for individual vehicles.

- The incentive amount available for the purchase of the vehicle will be based upon three criteria: cost-effectiveness of the project based upon the weighted NOx + ROG + combustion PM10 emission benefits as calculated by the district; the value of the used vehicle based upon the National Automotive Dealership Association (N.A.D.A.) adjusted loan value or new vehicle invoice price; and, less any costs associated with repairs noted during the vehicle inspection.

- The maximum reimbursement for all awards will be the N.A.D.A. adjusted loan value of the replacement truck or the maximum calculated incentive -- whichever is less. The funding amount of a <u>used</u>, replacement vehicle shall not exceed the value of the vehicle given by the N.A.D.A. commercial vehicle guide adjusted loan value. The funding amount of a <u>new</u> replacement vehicle shall not exceed 80 percent of the invoice price.

- If suitable equipment is available and deemed cost-effective by the district, supplemental incentive funding will be provided to cover installation of a DECS and/or an EMU.

- Incentive funding can only be used to pay for items essential to the operation of the vehicle. Optional items, such as cigar lighters and custom mud flaps, must be paid for at the owners expense.

- The participant may obtain financing to assist in the purchase of a replacement vehicle.

B. Dealer Requirements

Districts are encouraged to establish contracts with dealers that are selling replacement vehicles to fleet modernization participants. Experience with the pilot programs has shown that dealers have provided participants with needed assistance in the application process. Vehicle dealers are encouraged to help in the application process as much as possible. If districts use vehicle dealers in implementing the fleet modernization category, reimbursement cannot be issued until all forms are submitted and approved by the district.

Participants may purchase the replacement vehicles from a private party, provided all required documentation is submitted. This includes warranty requirements and all other fleet modernization requirements.

Vehicle dealers are expected to do the following:

- Provide basic information about the fleet modernization category. Districts will provide liaison training to dealership staff.

- Inform participants of rights and responsibilities as outlined in the district and ARB guidelines.

- Help the participants complete the application. The vehicle dealers will ensure that the participant correctly completes the application. It is important to make sure that all information is filled out correctly and that the participant understands the meaning of the program and the contract. The district will provide all forms and certificates as appendices to the application. Once complete, the dealer will submit the application package to the district.

To ensure that an application package is complete, the dealer will make sure that all the following items are complete and included in the participant's submission to the district. The following must be completed before reimbursement can be made:

- Submit a signed and complete application.

- Provide documentation showing that the old vehicle is roadworthy. This includes documentation showing that the old vehicle has passed a CHP BIT inspection old vehicle in the past 90 days or conduct an equivalent vehicle inspection and sign as appropriate. The district reserves the right to audit the dealer's record of inspection.

- Provide invoices of all work performed on the replacement vehicle. The invoices must include all engine, transmission, body and other work performed on the replacement vehicle. Invoices must include the installation of all equipment required by this program: EMU (at the discretion of the district), diesel emission control

system (at the discretion of the district), and engine horsepower derated, if necessary.

- Submit digital photographs of the old vehicle and the replacement vehicle to the district. The district will specify the required digital format. Reimbursement will not be processed until all photographs are received and verified by the district. Before submitting photographs to the district, dealers must verify that photographs are clear. All VIN and engine serial numbers must be legible.

  Photographs of the old vehicle must include the following views:

  – Right Side - hood down.
  – Front - hood down.
  – Left Side - hood down.
  – VIN Tag - inside vehicle or on frame rail.
  – Engine - left side.
  – Engine - right side.
  – Engine Serial Number - either tag or stamp on block.
  – License plate.
  – Rear.

  Photographs of the replacement vehicle must include the following views:

  – Right Side - hood down.
  – Front - hood down.
  – Left Side - hood down.
  – VIN Tag - inside vehicle.
  – VIN Tag - on frame rail.
  – Engine - left side.
  – Engine - right side.
  – Engine Serial Number and Engine Information – tag.
  – License plate.
  – Rear.
  – Electronic Monitoring Unit (in working condition).
  – Diesel Emission Control Device (if available).
  – Odometer Reading.
  – Additional modifications (if applicable).

- Provide certification that the old vehicle will be delivered to a qualified salvage yard. The certification must state that the dealer will deliver the vehicle to the salvage yard within 30 days of receipt of the old truck. The contract must include the make, model, year, VIN, engine make, engine serial number, and the date the vehicle is expected to be delivered. It is the dealer's responsibility to ensure that the salvage actually occurs, to obtain the completed Certificate of Vehicle Destruction, and to ensure that the Certificate of Vehicle Destruction has been filed with the district. The district will not cover the salvage costs.

- Provide documentation of replacement vehicle warranty and registration.

- Provide proof of replacement vehicle financing. The financing package will enable the district to determine the reimbursement costs that may be accrued in case the participant defaults on the contracted performance requirements.

Prior to releasing the replacement vehicle to the participant, the dealer must have documentation of a district pre-inspection of the old vehicle and a post-inspection of the replaced vehicle. Upon request of the district, ARB may waive inspection requirements.

After the application and all required documentation have been approved by the district, the dealer must provide the district with proof of sale of the replacement vehicle.

C. Salvage Requirements

Destruction of the old vehicle chassis and engine permanently removes the old, high emitting vehicles from service. The old vehicle must be driven to a qualified vehicle salvage yard for destruction. Vehicle salvage yards are required to enter into an agreement with the district to qualify for participation. Qualified vehicle salvage yards are required to be licensed by the Department of Motor Vehicles (DMV) as an auto-dismantler; have a current, valid California Environmental Protection Agency (Cal/EPA) Hazardous Materials Generators Permit; and be in compliance with all local, state and federal laws and regulations.

Funding is not available for the salvage of any old vehicle. The vehicle salvage value will be negotiated between the participant, the dealership and the salvage yard. The salvage yard operator must do the following:

- Dismantle the old vehicle within 60 days of receipt. The destruction must be done in accordance with program guidelines.

- Drill a hole in the engine block of the old vehicle to ensure that block will not be used again.

- Cut the frame rails of the old vehicle to ensure that the vehicle will not be used again.

- Take photographs of the hole in the engine block and the cut frame rails. Photographs of the destroyed engine block and cut frame rails must be provided to the district within ten business days of salvaging the vehicle. The following picture views must be taken:

  - Front of vehicle with hood down.
  - Right side of vehicle with hood down.
  - Left side of vehicle with hood down.
  - Serial number printed either on the tag inside in the cab or on the frame rail.

- Engine side view.
- Engine serial number either stamped on the block or on the tag.
- Hole in the engine block either in-frame or out of frame.
- Cut frame rails.

- File a “Non-Repairable Vehicle Certificate” with the DMV.

- Upon request of the district, ARB may approve an alternative disposition for the old vehicle.

D. Pre- and Post-Inspections

To protect the integrity of the fleet modernization source category, districts must conduct a pre-inspection of the old vehicle and a post-inspection of the replacement vehicle. Districts are encouraged to design rigorous pre- and post-inspection procedures. At a minimum, the inspection of the old vehicle must be conducted to establish that it has been in service, that it meets the described weight class and configuration, and that costs associated with needed repairs have been identified and deducted from the incentive award. The cost of repairs needed for the old vehicle will be subtracted from the incremental cost of the grant award.

Post-inspection of the replacement vehicle must be conducted to verify that the vehicle meets the contract description, including class and configuration descriptions, DECS and EMU installation, and any other items deemed necessary to confirm the authenticity project. Upon the request of the district, the ARB may approve an alternative method of ascertaining the authenticity of the old and replacement vehicle.

E. Minimum Reporting Requirements

Fleet modernization reporting requirements have been established to verify that project participants meet contract requirements and to quantify the emission reductions achieved through the Carl Moyer Program. Fleet modernization projects are subject to the following minimum reporting requirements:

- If the participant has a California Motor Carrier Permit, a current copy must be submitted to the district annually. If the participant does not have a California Motor Carrier Permit, the participant must provide registration and proof of insurance to the district annually.

- The participant must provide annual reports for the life of the project. The report on the replacement truck will include information such as the number of hours of operation, miles driven in the district and California, the amount of fuel consumed in the twelve months preceding the report date, details regarding maintenance and servicing, and any other items specified by the district.

- Participants from targeted vocation categories must provide documentation of vocation on an annual basis.

- If the replacement vehicle is involved in an accident, the participant must report the accident to district staff within 14 days. The participant will be required to provide a police report of the accident, a letter from the insurance company regarding the accident and any additional information requested by the district. The participant is required to repair the vehicle and return it to operation, if possible. Down time due to an accident will be credited toward the performance requirements as along as the information is reported as requested and the repairs are made as soon as possible. If the vehicle is totaled, the participant and the district staff must come to an agreement regarding any requirements that still need to be met.

F. Compliance Checks

After the district qualifies fleet modernization projects for funding, but before the district APCO signs an agreement for funding a project, the district must submit the project to ARB to check for outstanding violations. The process for completing the compliance check is as follows:

- The district shall email their ARB district liaison the contact name, organization or business name and VIN for the project.

- The liaison shall then forward that information electronically to the responsible parties at ARB. The liaison will email the district the results of the compliance check within five working days.

- If the compliance check indicates there is an outstanding violation the district shall inform the applicant in writing that no disbursement may be made until the owner provides proof that the fines have been paid.

- Clearance of the citation requires proof of repair or a “Statement of Facts” documenting that the old truck will be scrapped. The “Statement of Facts” can be written by the dealer or the participant explaining the old truck will be scrapped as required by the Carl Moyer fleet modernization program. The statement and a copy of the fleet modernization contract should be provided along with the penalty payment. Include the citation number on all documents.

G. Recovery of Incentive Funds

The district must establish a mechanism to assure the participant fulfills all contractual obligations. This includes owning and operating the replacement vehicle for the project life, and staying in the agreed upon vocation for the duration of the contract. Participants must meet an 80 percent minimum baseline mileage requirement for the life of the project and agree to repay a pro-rated portion of the incentive funding for failure to fulfill the minimum performance requirements. The district will determine the method of notice and achieving fund recovery. Options may include:

- List the district as co-lien holder on the title of the replacement vehicle for the term of the agreement. The participant must submit a completed Uniform Commercial Code-1 Financing Statement Form to the California Secretary of State, with a copy sent to the district, within 30 days of the purchase of the replacement vehicle. The financing statement must have the district as the secured party and the vehicle should be listed as collateral.

- The participant must be the registered owner of the replacement vehicle for the project life. If the replacement vehicle is sold within the project life, the new owner must assume the obligations under the participant's contract with the district and comply with the terms and conditions of the contract. The district must approve the change in ownership prior to the sale.

XI. References

ARB 2002. California Emissions Inventory Model, EMFAC2002, v2.2 (Apr03).

ARB 2005. California Emissions Inventory Model, EMFAC2005.

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Chapter Three

REDUCING IDLING EMISSIONS FROM HEAVY-DUTY VEHICLES

This chapter addresses the project criteria for idling reduction technologies that may be installed on on-road heavy-duty vehicles. Projects that meet the criteria may be considered for Carl Moyer Program funding. This chapter contains a brief overview of the engine idling practices of truck operators, emission inventories, available control technology, emission reductions and cost effectiveness calculations. This chapter expands eligible idling reduction techniques to electrification projects. Information specific to electric auxiliary power units (APU) and other zero-emission technologies is provided in Chapter 12: Zero-Emission Technologies.

I. Introduction

Heavy-duty vehicles are employed in line-haul service carrying goods across the state and throughout the nation. The majority of heavy-duty vehicles are powered by diesel engines. Heavy-duty vehicles employed in line-haul service are typically greater than 33,000 pounds gross vehicle weight rating (GVWR), are grouped under a Class 8 truck classification, and often accrue very high annual mileage. It is not uncommon for a line-haul truck to accrue 100,000 miles or more annually. These heavy-duty vehicles (HDV) idle at low engine speeds for a significant amount of time for various operational reasons. The low engine efficiency at these idle speeds results in significant increases in fuel consumption and emissions.

Truck idling practices vary among different fleets, operators, and geographical locations. Two main purposes of idling are to keep the engine and fuel warm, especially in cold weather, and to heat or cool the truck's cab/sleeper compartment. Although technologies for reducing idling emissions from heavy-duty trucks are commercially available, relatively high initial costs have prevented these idling reduction strategies from being more widely utilized.

The average power demand for an APU operating under extreme climate conditions is estimated to be approximately 2.3 kilowatts (kW) for winter conditions and 3.1 kW for summer conditions [Wallace, 2003; Lutsey, 2003]. Staff assumed that the diesel-fueled APU would provide an average of 2.7 kW power to provide sleeper berth comfort and electrical power for accessories.

The Carl Moyer Program can provide incentives to reduce emissions from truck idling by encouraging the purchase and installation of alternative idling reduction technologies. These technologies not only reduce idling emissions from heavy-duty trucks, but can also result in fuel savings and reduced maintenance costs to truck operators.

II. Emissions

According to the Air Resources Board's (ARB or "Board") emission inventory, idling emissions from heavy heavy duty diesel (HHD) trucks account for approximately 29 tons per day (tpd) of nitrogen oxides (NOx), 1.6 tpd of reactive organic gases (ROG) and 0.7 tpd of particulate matter (PM10). This represents about 7 percent of the total NOx, ROG and PM10 emissions from this sector of vehicles in California. Idling emissions from individual trucks are significant and the idling emission rate for HHD diesel trucks is large. For example, a single HHD truck that idles an average of 1,500 hours per year emits approximately: 564 pounds/year of NOx, 114 pounds/year of ROG and 7.6 pounds/year of PM10 from idling.

III. Regulatory Requirements

A. School Bus Idling

An airborne toxic control measure (ATCM) became effective on July 16, 2003, that restricts idling by school buses and other special classes of vehicles at schools. The regulation also limited the idling of these buses and vehicles to no more than five minutes when within 100 feet of a school. [ARB, 2003]

B. Heavy-Duty Vehicle Idling

On February 1, 2005, an ATCM became effective that extended idling limitations beyond school buses to include diesel APUs, and heavy-duty diesel trucks over 10,000 GVWR. The ATCM specifically limits idling of the main engine or the operation of diesel-fueled APU systems when health, safety or operational concerns are not an issue. This regulation limits the idling of HDVs to no more than five minutes if the truck is within 100 feet of a school or home. These requirements apply to both California and non-California trucks.

In addition to statewide restrictions on idling, some local government and municipalities have ordinances restricting idling time for some types of vehicles. Carl Moyer Program funding for projects must be surplus to the requirements of both the ATCM and local ordinances.

C. Proposed Idling Restrictions

In October 2005, the Board will consider a proposal that would remove the exemption for idling of heavy duty trucks equipped with sleeper berths. This proposal would prohibit heavy duty trucks with sleeper berths from idling more than five minutes unless certain conditions are met. Beginning in 2008, model year 2006 and older trucks may operate certified diesel APUs. Model year 2007 and newer trucks may only operate an APU for longer than 5 minutes if the exhaust of the APU is equipped with a Level 3 PM retrofit device or is routed through the main engine exhaust with a Level 3 PM retrofit device; however, the truck must not be within 100 feet of a restricted area such as a school or residential area. In addition, 2008 and subsequent model year heavy-duty

trucks may idle longer than five minutes in a non-restricted area if the main engine meets a low NOx standard of 30 g/hr. [ARB, 2004]

If the Board approves the staff recommendations, the baseline for calculating the benefits of truck idle reduction projects would be a certified diesel APU. Zero-emission technologies would be eligible for funding using the lower emission baseline.

IV. Potential Projects

A. Auxiliary Power Units

APUs are usually installed on the truck chassis outside the truck cab to provide power for the truck's accessory loads and to keep the engine warm when the truck is parked. This allows the operator to refrain from idling the truck's main engine. The extent of labor involved in the installation of an APU on the truck depends on the configuration of the truck engine and chassis and the plumbing of its heating/cooling system. Heating and cooling of the cab compartment are accomplished through either dedicated equipment supplied with the APU or through the truck's existing heating and cooling system. APUs are commercially available and meet most of the power needs of truck operators. Some APUs are available with an electric option for a few hundred dollars more.

B. Truck Stop Electrification

Another strategy for reducing truck idling is the retrofit of trucks with components such as engine block heaters, fuel heaters, electric heaters and air conditioning for cab/sleeper areas. This strategy requires the installation of charging infrastructure at truck stops and rest areas. Specific information and project criteria pertaining to truck stop electrification is provided in the Zero-Emission Technologies Chapter.

C. Advanced Travel Center Electrification

An alternative to truck stop electrification that does not require truck modification has been introduced by IdleAire Technologies. Specific information and project criteria are provided in the Zero-Emission Technologies Chapter.

D. Direct-Fired Heaters and Thermal Storage

Direct-fired heaters for truck heating applications are devices that use the combustion heat of a small internal combustion engine to provide heat directly to the truck's cab/sleeper area through the use of a small heat exchanger. Because it is designed to provide heat directly from a combustion flame, the heating efficiency of these units is higher than that obtained through the truck's engine due to reduced mechanical losses and fuel consumption. Two primary limitations of direct-fired heaters for this application are that they cannot provide cooling and that they draw on the truck's battery power during operation. Direct-fired heater technologies continue to evolve, but they have not gained widespread commercial acceptance.

Thermal storage systems provide both heating and cooling for the cab/sleeper area. This technology uses the heat of transformation associated with material phase change to provide heating and cooling to the cab/sleeper area. However, the technology cannot provide cooling at night unless the truck's air conditioner was used in the daytime.

V. Proposed Project Criteria

The project criteria for eligible idling reduction strategies for heavy-duty vehicles provide districts and fleet operators with the minimum requirements for participation in the Carl Moyer Program. The criteria have been developed specifically for idling reduction technologies that will be installed on a heavy-duty truck to reduce the truck's idling emissions. The ARB may develop additional project criteria for idling reduction strategies if additional technologies enter the market.

Idling reduction technologies provide a cost-effective means to reduce idling emissions from heavy-duty diesel trucks. Carl Moyer Program funds can be used to pay for a portion of the capital cost of idling reduction equipment as well as the installation costs.

A. General Criteria

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding, settlement agreement, mitigation requirement, or other legally binding document.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10, reduced calculated in accordance with the cost-effectiveness methodology discussed in this section.

- No emission reductions generated with funding from the Carl Moyer Program shall be used as marketable emission reduction credits, or to satisfy any emission reduction obligation of any person or entity.

- No emission reductions from a project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging, banking and trading program

- Carl Moyer Program grants shall be no greater than a project’s incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including but not limited to tax credits or deductions, grants, or other public financial assistance.

- Projects must have a minimum project life of three years. The ARB may approve shorter project life in writing for good cause on a case-by-case basis. Projects with

shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The contract term must extend to the end of the project life.

- The default project life does not consider upcoming regulatory requirements. Project life may be shorter due to regulatory requirements.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

- Repower projects must provide at least a 15 percent NOx emission benefit compared to baseline idling NOx emissions.

- 75 percent of the APU usage must be in California. The ARB may approve exceptions on a case by case basis.

- Air districts are encouraged to co-fund projects that will produce emission reductions in more than one air district.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis is evidence provided to the air district suggests potential surplus, real, quantifiable and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on a case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

B. APUs and Alternative Technologies

- The engine used in an APU must meet current emission standards, be certified by the ARB for sale in California, and comply with all applicable durability and warranty requirements.

- If an internal combustion engine APU is available with an electric option, the ARB strongly recommends installation of the electric option.

- An hour-meter or other means to measure usage must be installed with an APU to track operation. The participant shall provide this information to ARB or the district upon request during the life of the project.

- The default load factor for the engine used in an APU shall be the maximum power rating of the engine, unless another load factor is proposed by the participant and supported by proper documentation as determined by the ARB.

- Emission benefits must be based on the vehicle's idling time that occurs in California. At least 75 percent of the idling time must be in California. ARB may approve exceptions on a case-by-case basis.

- The actual capital cost, up to $5,500, of an APU may be eligible for funding.

- The installation cost of an APU, including installation of an hour-meter, up to a maximum of $1,700 per diesel APU and a maximum of $3,400 per alternative fuel, electric motor, or fuel cell APU, may be funded.

- The full cost of a PM retrofit device may be funded provided that the cost-effectiveness for the overall project does not exceed $14,300.

C. Scrap

- A baseline engine in a repower project must be destroyed by scrapping or drilling a hole in the engine block rendering it inoperable unless prior approval for alternate disposition has been granted by ARB staff. At the discretion of the district, core charges are eligible for funding and, if included, must be part of the cost-effectiveness calculation.

VI. Minimum Project Requirements

A. Application

In order to qualify for incentive funds, districts make applications available and solicit proposals for reduced-emission projects from HDV operators. The applicant must provide at least the following information listed in Table 3-2.

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner’s behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being

used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

Table 3-2 Minimum Application Information Auxiliary Power Unit Projects

1. Air District 2. Project Funding Source: 3. Applicant Demographics Company Name: Business Type: Mailing Address: Location Address: Contact Number: 4. Project Description Project Name: Project Type: Vehicle Function: Vehicle Class: GVWR(lbs): 5. NOx, ROG and PM10 Reduction Incremental Cost-effectiveness Analysis Basis: (Mileage/Fuel/Hours of Operation) 6. VIN or Serial Number: 7. Application: (Repower, Retrofit , Idling, or New) 8. Percent Operated in California: 9. APU Engine Information Horsepower Rating: Engine Make: Engine Model: Engine Year: Fuel Type:	10. NOx, ROG and PM10 Emission Reductions Baseline NOx, PM10 and ROG Emissions Level (g/hr): NOx+HC+PM10 Emissions Standard (g/kW-hr): Estimated Annual NOx, PM10 and ROG Emissions Reductions: Estimated Lifetime NOx, PM10 and ROG Emissions Reductions: 11. Cost ($) of Certified APU or Alternate Technology: 12. Installation Cost ($) of APU or Alternate Technology: 13. Annual Diesel Gallons Used: 14. Annual Hours Idled (Must be documented or justified): 15. APU Load Factor (Must be documented or use default value of 100 percent): 16. Project Life (years): 17. Existing Truck Engine Information Truck Horsepower Rating: Truck Engine Make: Truck Engine Model: Truck Engine Year: 18. District Incentive Grant Amount Requested: 19. Project Contact:

B. Reporting and Monitoring

The district has the authority to conduct periodic checks or solicit operating records from the applicant that has received Carl Moyer Program funds for emission reduction projects. This is to ensure that the APU is operated as stated in the program application. Fleet operators participating in the Carl Moyer Program are required to keep appropriate records during the life of the project. Records must contain, at a minimum, total California hours idled. Records must be retained and updated throughout the project life and made available at the request of the district.

VII. References

ARB, 2003. Final Regulation Order: Airborne Toxic Control Measure to Limit School Bus Idling And Idling At Schools. July 16, 2003.

ARB, 2004. Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Airborne Toxic Control Measure for Idling Reduction. September 1, 2005.

Lutsey, Nicholas. Fuel Cells For Auxiliary Power in Trucks: Requirements, Benefits, and Marketability. Institute of Transportation Studies, University of California, Davis. UCD-ITS-RR-03-04. July 2003.

Wallace, John Paul. Modeling of Line-Haul Truck Auxiliary Power Units in ADVISOR 2002. Institute of Transportation Studies, University of California, Davis. UCD-ITS-RR-03-07. August 2003

Chapter Four

TRANSPORT REFRIGERATION UNITS

This chapter is a new source category and presents the project criteria for transport refrigeration units (TRU) and transport refrigeration generator sets. This chapter also contains a brief overview of the engine operating characteristics of transport refrigeration units, emission inventory, available control technology, potential projects eligible for funding, and emission reduction and cost-effectiveness calculation methodologies. Information is also provided for potential consideration of other alternative technologies or strategies that may offer real emission reduction of transport refrigeration unit operations from transport refrigeration unit diesel engines. For more information about zero-emission technology, consult Chapter 12: Zero-Emission Technologies.

I. Introduction

TRUs are employed in service carrying perishable goods throughout the world. TRUs use an internal combustion engine to run the compressor of the refrigeration system. TRUs and TRU generator sets operating in the United States are generally powered by diesel engines, typically between 9 and 36 horsepower. TRUs may be installed on trucks, trailers, shipping containers, and railcars to refrigerate perishable contents. When a refrigerated trailer becomes disconnected from the tractor, the trailer TRU will continue to maintain temperature. When the tractor is parked at a rest stop or shut down, the TRU engine continues to cycle. TRU generator sets are also attached to ocean-going shipping containers when they are on land, to provide electric power to the shipping container's refrigeration system between the port and cold storage warehouse or distribution center.

II. Emissions

There are currently about 31,000 TRUs and TRU generator sets based in California, and another 7,500 out-of-state refrigerated trailers and 1,700 railcar TRUs operating in California at any given time. The Air Resources Board (ARB or “Board”) estimates that emissions of diesel particulate emissions from TRUs and TRU generator sets were almost two tons per day or 2.6 percent of the total statewide diesel particulate matter emissions in 2000. Estimated NOx emissions in 2000 were about 20 tons per day. Based on emission projections, the diesel PM10 emissions from TRUs will decrease to about 1.6 tons per day in 2010 and decrease again to about 0.3 tons per day in 2020, because of the cumulative effects of new emission standards and ARB's in-use TRU Airborne Toxic Control Measure (ATCM).

III. Regulatory Requirements

In February 2004, the Board approved an ATCM for TRUs that set in-use performance standards for PM10 emissions beginning in 2008. Compliance is phased in over the next 12 years.

The TRU ATCM In-Use Performance Standards and compliance dates must be considered when determining whether emission reductions are surplus. Table 4-1 gives the TRU and TRU Generator Set In-Use Performance Standards and Table 4-2 provides a graphical representation of the implementation schedule. The region in Table 4-2 labeled Potential Surplus Reductions shows a window of opportunity where projects can achieve emissions reductions prior to the compliance date of the TRU ATCM [ARB, 2003].

Table 4-1
TRU and TRU Generator Set In-Use Performance Standards

Horsepower Category	Engine Certification Value PM10 Emissions Standard (grams/horsepower-hour)	Options for Meeting Performance Standard
Low Emission Performance Standards		
less than 25	0.30 g/hp-hr	▪ Use an engine that meets the Engine Certification Value ▪ Retrofit with at least Level 2 DECS* (≥50% PM10 reduction) ▪ Use an Alternative Technology
25 or greater	0.22 g/hp-hr	▪ Use an engine that meets the Engine Certification Value ▪ Retrofit with at least Level 2 DECS ▪ Use an Alternative Technology
Ultra-Low Emission Performance Standard		
less than 25	N/A	▪ Retrofit with Level 3 DECS (≥85% PM10 reduction) ▪ Use an Alternative Technology
25 or greater	0.02 g/hp-hr	▪ Use an engine that meets the Engine Certification Value ▪ Retrofit with Level 3 DECS ▪ Use an Alternative Technology

* Diesel Emission Control System

- **Table 4-2**

≥ 25 hp TRU and TRU Generator Set Engines In-Use Compliance Dates
(Compliance date is December 31 of applicable year)

MY	In-Use Compliance Year													
	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20
'01 & Older		L	L	L	L	L	L	L	U	U	U	U	U	U
'02			L	L	L	L	L	L	L	U	U	U	U	U
'03				U	U	U	U	U	U	U	U	U	U	U
'04	Potential Surplus Emissions				U	U	U	U	U	U	U	U	U	U
'05						U	U	U	U	U	U	U	U	U
'06							U	U	U	U	U	U	U	U
'07								U	U	U	U	U	U	U
'08									U	U	U	U	U	U
'09										U	U	U	U	U
'10											U	U	U	U
'11												U	U	U
'12													U	U
'13														

< 25 Hp 2013 and subsequent MY must meet ULETRU 7 years after MY
L = Low-Emission TRU, U = Ultra Low-Emission TRU

IV. Potential Projects

TRU owners can apply for Carl Moyer Program grant funds for projects that achieve surplus emission reductions by repowering with cleaner certified engines, installing verified retrofit diesel emission control strategies, or using alternative technologies to reduce or eliminate NOx, ROG, and PM10 emissions. Many of the technologies discussed below have not yet been verified. However, they are included in this discussion since they could provide real emission reductions and could potentially be verified during the time frame covered by the Guidelines.

A. New Purchase

Purchase of a new TRU is eligible for Carl Moyer Program funding if the new TRU is cleaner than what would have normally been purchased – a diesel engine. Thus the incremental cost of the new purchase of alternative technologies may be eligible for Carl Moyer Program grants.

B. Repower

Repowering TRUs with cleaner certified diesel engines is one type of potential project. However, there may be some compatibility issues with some engines due to spatial and electronic control differences (e.g., the new engine is too big to fit in the available space or the electronic controls are incompatible). Those compatibility issues must be resolved prior to submitting a grant application.

C. Retrofit with a Diesel Emission Control Strategy

Retrofit with a diesel emission control strategy is another potential project if the retrofit is not required by the TRU ATCM or any other regulation. Diesel retrofit systems must be verified by ARB in order to qualify for Carl Moyer Program funding. Potential retrofits include diesel oxidation catalysts, diesel particulate filters, flow though filters and fuel additives.

D. Alternative Technologies to Reduce or Eliminate NOx, ROG, and PM Emissions

Alternative technologies are defined under the TRU ATCM as electric standby, cryogenic temperature control systems, alternative fuels, alternative diesel fuels, fuel cells, and other systems that reduce or eliminate diesel engine operation. Brief descriptions of each of these potential project types follow.

1. Electric Standby

Electric standby equipped TRUs allow the TRU engine to be shut off when a compatible electric power supply is available at a facility so TRU diesel engine emissions are eliminated while the TRU is plugged in at the facility. See the Zero-Emission Technology Chapter for more information.

2. Hybrid Electric TRU

Hybrid electric TRUs have been available in Europe for several years. The diesel engine drives a generator that, in turn, powers an electric semi-hermetic refrigeration compressor and electrically driven fans, all controlled by an advanced microprocessor. This hybrid electric TRU is easily adaptable to run on electric grid power when at a facility, so that diesel engine operation is eliminated. The cost is higher than a traditional TRU, but costs less than it would to retrofit a traditional TRU with an electric standby system. One big advantage is that the hybrid design provides full refrigeration capacity for the initial chill-down. The hybrid design is also very likely to be adaptable for future use with fuel cell technology

3. Cryogenic Temperature Control Systems

Cryogenic temperature control systems heat and cool using a cryogen, such as liquid carbon dioxide or liquid nitrogen that is routed through an evaporator coil that cools air blown over the coil. Since there is no diesel engine, diesel PM10 emissions are eliminated. Capital costs for these types of systems are ten percent higher than a diesel TRU, but the facility infrastructure costs for cryogenic "fuel" storage and dispensing add to the capital cost.

4. Alternative Fuels

Conventional diesel engines are internal combustion, compression-ignition engines. In contrast, engines that operate on an alternative fuel, such as compressed natural gas (CNG), liquefied natural gas (LNG), and liquid propane gas (LPG), are usually spark-ignited. Engines certified to operate on alternative fuels produce substantially lower PM10 and NOx emissions than diesel-fueled engines that are not equipped with exhaust after-treatment.

5. Alternative Diesel Fuels

Before any alternative diesel fuel can be used to comply with a diesel PM10 control measure or used in a Carl Moyer Program project, it must be verified through ARB's Verification Procedure, which includes a special section that deals specifically with alternative diesel fuels.

The Carl Moyer Program does not fund fuel-only projects however, districts may use matching funds to pay for the incremental cost of alternative diesel fuels if they are part of a Carl Moyer Program project. Recordkeeping and reporting must provide assurance that the emission reductions are real, quantifiable, surplus and enforceable.

6. Fuel Cells

Compared to a conventional diesel-powered TRU, fuel cell TRUs would offer zero or near-zero emissions of criteria pollutants and lower greenhouse gas emissions. At this time, there are no fuel cells appropriately sized for use on a TRU, but electrically-driven TRUs could be powered by fuel cells on or off the road (e.g., at a facility).

V. Proposed Project Criteria

Participating districts retain the authority to impose additional more stringent requirements in order to address local issues.

A. General Criteria

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding, settlement agreement, mitigation requirement, or other legally binding document.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to satisfy any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging, banking, and trading program.

- Carl Moyer Program grants shall be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including but not limited to tax credits or deductions, grants, or other public financial assistance.

- Projects must have a minimum project life of three years. ARB may approve shorter project life in writing for good cause on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The contract term must extend to the end of the project life.

- The default project life does not consider upcoming regulatory requirements. Project life may be shorter due to regulatory requirements.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

- Projects with more than a 5 year project life must have a contract term of at least 5 years.

- Emission benefits must be based on the TRU operations that occur in California. 75 percent of TRU operations must be in California. The ARB may approve exceptions in writing on a case-by-case basis.

- Air districts are encouraged to co-fund projects that will produce emission reductions in more than one air district. (Most TRU projects will provide multi-district emission reductions.)

B. Repowers

- For repower projects, Carl Moyer Program funds shall only be used to pay for the incremental costs of an eligible engine and the cost to install that engine in the TRU equipment.

- The replacement engine for repower projects used in the TRU must meet current emission standards and be certified by the ARB for sale in California. Compliance with all applicable durability and warranty requirements is required.

- Repower projects must provide at least 15 percent NOx emission benefit compared to baseline NOx emission level.

- The participant shall install an hour-meter or other means to measure usage on the TRU to track operating hours, and shall provide this information to ARB or the district upon request.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis is evidence provided to the air district suggests potential surplus, real, quantifiable and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on a case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

C. Retrofits

- For retrofit projects, diesel emission control strategies used on TRUs must be verified by ARB for sale in California. Compliance with all applicable durability and warranty requirements is required.

- Alternative Technologies such as electric standby and pure cryogenic systems are not required to be verified, but ARB must review and approve such systems in writing on a case-by-case basis. The district shall require recordkeeping and reporting to assure that estimated emission reductions are achieved.

`D. Scrap

- A baseline engine in a repower project must be destroyed by scrapping or drilling a hole in the engine block rendering it inoperable unless prior approval for alternate disposition has been granted by ARB staff. At the discretion of the district, core charges are eligible for funding and, if including, must be part of the cost-effectiveness calculation.

VI. Cost-Effectiveness

In general, the emission reduction benefit represents the difference in the emission level of a baseline engine and reduced-emission engine, retrofit, or use of alternative technology. TRU engine annual emissions are calculated by multiplying the emission factor in grams per horsepower-hour for each pollutant by the rated hp, load factor, and activity (annual engine hours of operation).

VII. Minimum Project Requirements

A. Application

In order to qualify for incentive funds, districts make applications available and solicit proposals for reduced-emission projects from distribution centers and TRU owners. The applicant must provide at least the following information listed in Table 4-4.

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

B. Reporting and Monitoring

The district has the authority to conduct periodic checks or solicit operating records from the applicant that has received Carl Moyer Program funds for emission reduction projects. This is to ensure that the TRU is operated as stated in the program application. Fleet operators participating in the Carl Moyer Program are required to keep appropriate records during the life of the project. Records must contain, at a minimum, total California hours idled. Records must be retained and updated throughout the project life and made available at the request of the district.

Table 4-4
Minimum Application Information Transport Refrigeration Unit Projects

1. Air District 2. Project Funding Source: 3. Applicant Demographics Company Name: Business Type: Mailing Address: Location Address: Contact Number (email & phone): 4. Project Description Project Name: Project Type: 5. Truck, Trailer, Shipping Container, or Railcar I.D. Number (e.g., VIN, railcar recording mark and car number, container number, company I.D. number, or serial number): 6. Application: (Repower, Retrofit , or Alternative Technology) 7. Percent Operated in California: 8. Baseline TRU Engine Information TRU or Gen Set Make TRU or Gen Set Model Horsepower Rating Engine Make Engine Model Engine Model Year Fuel Type NOx emission factor PM10 emission factor Activity (annual hours of operation) Load Factor	9. Project Emission Reductions New Equipment Information TRU or Gen Set Make TRU or Gen Set Model Horsepower Rating Engine Make Engine Model Engine Model Year Fuel Type NOx Certification Value PM Certification Value Activity (annual hours of operation) Retrofit Emission Reduction Percentage NOx: ROG: PM10: Retrofit Verification Executive Order # Estimated Annual NOx Emissions Reductions: Estimated Lifetime NOx Emissions Reductions: Estimated Annual ROG Emission Reductions Estimated Lifetime ROG Emission Reductions Estimated Annual PM10 Emission Reductions Estimated Lifetime PM10 Emission Reductions 10. Project Incremental Capital Cost ($) (above normal) 11. Installation cost ($) 12. Project Life (years): 13. District Incentive Grant Amount Requested: 14. Project Contact:

VIII. References

ARB, 2003. ARB, Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Airborne Toxic Control Measure for In-Use Diesel-Fueled Transport Refrigeration Units (TRU) and TRU Generator Sets, and Facilities Where TRUs Operate, Stationary Source Division, Emissions Assessment Branch, October 28, 2003.

Chapter Five

COMPRESSION-IGNITION OFF-ROAD EQUIPMENT

This chapter presents the project criteria for off-road compression-ignition (CI) equipment projects under the Carl Moyer Program. It also contains a brief overview of the current regulations, incentive projects eligible for funding, project criteria, cost effectiveness calculations, and minimum application requirements for off-road CI equipment. Proposed updates to the project criteria in this chapter since the 2003 Guidelines include: 1) lowering the minimum engine horsepower (hp) to 25 hp, and 2) prioritizing Tier 2 or Tier 3 repowers.

I. Introduction

Off-road CI equipment eligible for Carl Moyer Program funding includes equipment 25 hp (19 kilowatt) or greater such as construction and agricultural equipment. This also includes auxiliary engines found on off-road equipment, marine vessels, and on-road vehicles. Excluded from this discussion are engines that propel or are used on locomotives, marine vessel propulsion, and most forklifts (except for class 7 forklifts) which are discussed in other chapters of these Guidelines. Aircraft engines are excluded from the Carl Moyer Program. In addition, the Carl Moyer Program does not apply to off-road engines used for underground mining operations, which are regulated by the Mining Safety and Health Administration.

II. Emissions

Off-road CI engines are used in a wide array of applications including agricultural tractors, backhoes, excavators, trenchers, and motor graders. Off-road equipment can be categorized broadly into equipment less than 175 hp and equipment equal to or greater than 175 hp.

Table 5-1 displays statewide population and emission estimates for off-road CI engines.

Table 5-1
Statewide Emissions from Off-Road Compression-Ignition Engines*
(tons per day)

	Population	NOx	ROG	PM10
2005	350,420	453	54	30
2010	354,175	354	24	39

*Includes agricultural, construction, dredging, drilling, industrial, and logging equipment.

III. Regulatory Requirements

A. Off-Road Compression Engine Regulations

The Air Resources Board (ARB or "Board") is preempted from regulating new farm and construction equipment less than 175 hp. The U.S. Environmental Protection Agency (U.S. EPA) has sole authority to regulate this type of equipment. ARB has the authority to regulate new off-road equipment equal to or greater than 175 hp and non-preempted off-road equipment less than 175 hp. ARB and U.S. EPA have worked closely to harmonize the off-road CI standards. ARB is not preempted from regulating in-use equipment; a discussion of these regulations may be found in Section III. B of this chapter.

Current off-road engine regulations contain exhaust emission standards that engines are not to exceed under steady state and transient conditions [ARB, 2000 and ARB, 2004b]. In addition, the regulations include provisions that assist engine manufacturers in complying with emission standards through: 1) flexibility provisions for equipment manufacturers, 2) Averaging, Banking, and Trading (ABT) programs, and 3) the Tier 4 Early Introduction Incentive for engine manufacturers. Since the objective of the Carl Moyer Program is the deployment of cleaner-than-required low-emission engines to achieve maximum emission reduction benefits, it is important to understand the regulatory provisions that allow for the sale of engines not meeting the current applicable emission standards.

1. Emission Standards

Emissions from off-road equipment between 175 and 750 horsepower were uncontrolled prior to 1996. Estimates of NOx emission rates from uncontrolled off-road engines range from 8.2 g/bhp-hr to 14 g/bhp-hr. In January 1992, the Board adopted exhaust emission standards for off-road diesel-cycle engines 175 hp and greater, effective beginning with 1996 model year engines.

In August 1996, the U.S. EPA, ARB, and off-road diesel engine manufacturers signed a Statement of Principles which called for harmonization of ARB and U.S. EPA off-road diesel engine regulations, as appropriate, in exchange for an accelerated introduction of progressively more stringent standards. The U.S. EPA adopted emission standards in 1998 and again in 2004 that provided for new NOx + non-methane hydrocarbons (NMHC), PM, and carbon monoxide (CO) emission standards for engines within different power categories in a tiered approach, commonly referred to as "Tier" standards. These standards are defined in Title 13, California Code of Regulations (CCR), sections 2423(b)(1). ARB has since amended the California exhaust emission standards for off-road diesel engines to harmonize with the federal requirements. Table 5-2 summarizes the existing and future emission standards for these engines.

Table 5-2
ARB and U.S. EPA Exhaust Emission Standards for New Off-Road Diesel Engines ≥ 25 hp (g/bhp-hr)

Maximum Rated Power (hp)	Tier	Model Year	NOx	HC	NOx+NMHC	CO	PM
25=<50	Tier 1	2000-2003	—	—	7.1	4.1	0.60
	Tier 2	2004-2007	—	—	5.6	4.1	0.45
	Tier 4 Interim	2008-2012	—	—	5.6	4.1	0.22
	Tier 4	2013 and later	—	—	3.5	4.1	0.02
50=<75	Tier 1	2000-2003[a]	6.9	—	—	—	—
	Tier 2	2004-2007	—	—	5.6	3.7	0.30
	Tier 3[b]	2008-2011	—	—	3.5	3.7	0.30
	Tier 4 Interim	2008-2012	—	—	3.5	3.7	0.22
	Tier 4	2013 and later	—	—	3.5	3.7	0.02
75=<100	Tier 1	2000-2003[a]	6.9	—	—	—	—
	Tier 2	2004-2007	—	—	5.6	3.7	0.30
	Tier 3	2008-2011	—	—	3.5	3.7	0.30
	Tier 4 Interim[c]	2012-2014	2.5	0.14	—	3.7	0.15
	Tier 4	2015 and later	0.3	0.14	—	3.7	0.15
100=<175	Tier 1	2000-2002[a]	6.9	—	—	—	—
	Tier 2	2003-2006	—	—	4.9	3.7	0.22
	Tier 3	2007-2011	—	—	3.0	2.6	0.22
	Tier 4 Interim[c]	2012-2014	2.5	0.14	—	3.7	0.15
	Tier 4	2015 and later	0.3	0.14	—	3.7	0.15
175=<300	Tier 1	1996-2002	6.9	1.0	—	8.5	0.40
	Tier 2	2003-2005	—	—	4.9	2.6	0.15
	Tier 3[d]	2006-2010	—	—	3.0	2.6	0.15
	Tier 4 Interim[c]	2011-2013	1.5	0.14	—	2.6	0.15
	Tier 4	2013 and later	0.3	0.14	—	2.2	0.15
300=<600	Tier 1	1996-2000	6.9	1.0	—	8.5	0.40
	Tier 2	2001-2004	—	—	4.8	2.6	0.15
	Tier 3[d]	2006-2010	—	—	3.0	2.6	0.15
	Tier 4 Interim[c]	2011-2013	1.5	0.14	—	2.6	0.15
	Tier 4	2013 and later	0.3	0.14	—	2.2	0.15
600=<750	Tier 1	1996-2001	6.9	1.0	—	8.5	0.40
	Tier 2	2002-2004	—	—	4.8	2.6	0.15
	Tier 3[d]	2006-2010	—	—	3.0	2.6	0.15
	Tier 4 Interim[c]	2011-2013	1.5	0.14	—	2.6	0.15
	Tier 4	2013 and later	0.3	0.14	—	2.2	0.15
≥750	Tier 1	2000-2005	6.9	1.0	—	8.5	0.4
	Tier 2	2006-2010	—	—	4.8	2.6	0.15
	Tier 4 Interim	2011-2014	2.6	0.30	—	2.6	0.07
	Tier 4	2015 and later	2.6	0.14	—	2.6	0.03

[a] ARB model years, U.S. EPA model years for Tier 1 start at 1998 for 50=<75 hp and 75=<100 hp, and 1997 for 100=<175 hp.

[b] Engine families in this power category may meet the Tier 3 PM standard instead of the Tier 4 interim PM standard in exchange for introducing the final Tier 4 PM standard in 2012.

[c] The implementation schedule shown is the three-year alternate NOx approach. Other schedules are available.

[d] Caterpillar, Cummins, Detroit Diesel Corporation, and Volvo Truck Corporation have agreed to comply with these standards by 2005.

2. Flexibility Provisions for Equipment Manufacturers

Current regulations for off-road heavy-duty CI engines contain a flexibility provision that allows original equipment manufacturers (OEMs) to use engines not meeting current applicable emission standards in their existing product line for new equipment. Thus, engines that are certified under the flexibility provisions do not comply with current applicable emission standards, and are not eligible for the Carl Moyer Program. The flexibility provision took effect with the introduction of Tier 2 engines (Tier 1 for power categories less than 50 hp) and applies separately for each engine power category. Engine families certified under the flexibility provision must have previously been certified to a prior engine standard, for example Tier 1.

There are four main elements to the flexibility program: 1) a percent-of-production allowance, 2) a small-volume allowance, 3) continuance of the Tier 1 allowance to use up existing inventories of engines, and 4) availability of hardship relief. The adoption of the Tier 4 emission standards added several additional components to the program including technical hardship allowances, retroactive use of flexibilities, delayed implementation, an economic hardship allowance, an early introduction incentive, and a labeling requirement. The percent-of-production allowance is the largest component of the program and allows each equipment manufacturer to use flexibility engines in their new product line over a seven-year period in cumulative quantities that sum up to 80 percent of a single year's national production at the end of the seven years.

Except for engines used in flexibility allowances prior to January 1, 2007, flexibility engines will be labeled according to the requirements of Title 13, CCR, sections 2423(d) and 2424(c). In addition, the Executive Order (EO) for engines certified under this program state that the engines were certified in compliance with Title 13, CCR, section 2423(d).

3. Averaging, Banking, and Trading

Off-road engine manufacturers are allowed the flexibility to participate in an ABT program in lieu of only producing engines that comply with the current emission standards. The emission benefits from an engine certified to a lower Family Emission Limit (FEL) may be used to offset the emissions from engines certified to a higher FEL levels within the engine manufacturer's ABT program. As a result, ABT emission credits are generated from the lower FEL level engine since it is certified lower than the required emission standards. These engines are only eligible for Carl Moyer Program funding as part of repower projects. In these cases, the emission standard, not the certified FEL level, will be used in emission calculations. The FEL emission level is identified on the EO and is located under the emission standard.

4. Tier 4 Early Introduction Incentives for Engine Manufacturers ("Engine Offsets")

Engine manufacturers may voluntarily certify engines to the Tier 4 standards prior to 2011 in exchange for making fewer Tier 4 engines after 2011. These early introduction Tier 4 engines are not eligible for Carl Moyer Program funding. These engines are first offered to OEMs to use as part of the flexibility program (see Section III. A. 2 above). Should the OEM decline the engine, the engine manufacturer may use it as part of the "Tier 4 Early Introduction Incentive for Engine Manufacturers" created by Title 13, CCR, section 2423(b)(6).

Engines used as part of the "Tier 4 Early Introduction Incentive for Engine Manufacturers" must be in production by September 1 of the year prior to the first model year when the standards would otherwise be applicable, where the model year means the manufacturer's annual production period which includes January 1 of a calendar year or, if the manufacturer has no annual production period, the calendar year. Engines sold during the transitional "phase-in" model years (years where the Tier 4 interim standards are in effect) are not considered "early" introduction engines.

These engines will meet all federal labeling requirements but will add the following statement: "This engine meets U.S. EPA emission standards under 40 CFR 1039.104(a)" and an additional statement of "meeting ARB requirements under 13 CCR section 2423(b)(6)". In addition, the EO for engines certified under this program will reference that the engines were certified in compliance with 13 CCR section 2423(b)(6).

B. Upcoming Regulations

The ARB is developing a cargo handling equipment regulation that is scheduled for Board consideration in December 2005. This regulation would apply to diesel-fueled cargo handling equipment at California's ports and intermodal railyards. Cargo handling equipment is used to transfer goods and includes equipment such as yard tractors (hostlers), rubber tire gantry cranes, top handlers, side handlers, forklifts, loaders, and mobile cranes. Specific Carl Moyer Program project criteria will be identified for this equipment after the regulation is approved.

The ARB is also developing a control measure to reduce diesel particulate matter emissions from in-use, off-road, diesel-fueled, mobile equipment greater than or equal to 25 horsepower. This includes, but is not limited to, construction equipment, mining equipment, airport ground support equipment, and industrial equipment such as forklifts. The proposal will not cover equipment used in agricultural operations, cargo handling at ports and intermodal rail facilities, or equipment already covered by an in-use rule or agreement. This item is scheduled to be heard by the Board in 2006. If approved, it may affect project criteria for off-road projects.

IV. Potential Projects

The Carl Moyer Program can achieve significant emission reductions from off-road diesel engines and equipment operating in California. All eligible projects must use certified technology or technology that has been verified by the ARB for real and quantifiable emission reductions that go beyond any regulatory requirement. The project criteria included in this chapter are designed to ensure that emission reductions achieved by the deployment of reduced-emission engines or retrofit technologies are surplus, real, quantifiable, and enforceable.

Off-road projects fall into three distinct categories: 1) new purchase of an emission certified engine, 2) repower with an emission certified engine, and 3) retrofit with a verified diesel emission control strategy (DECS). Based on past experience, most projects will likely fall under the repower category for off-road projects. Emerging reduced-emission technologies, such as engine retrofit or new engine technologies, will become eligible for program participation after ARB grants verification or certification for sale in California. Districts have the option to fund the cost difference between conventional diesel fuel and an alternative fuel such as alternative-diesel fuel, CNG, LNG, and LPG with matching funds. The fuel purchase must be an integral part of an engine purchase, repower, or retrofit.

Auxiliary engines on mobile equipment are considered portable engines and are regulated by the ARB's Portable Equipment Air Toxics Control Measure (ATCM). Auxiliary engines that are an integral part of the vehicle's or vessel's main function, and are not covered under any district rule may be eligible for Carl Moyer funding. Because the ATCM requires that all portable engines be certified engines by January 1, 2010, projects must begin by January 1, 2007 to meet the minimum three year project life requirement [ARB, 2004a].

Class 7 diesel forklifts are the only diesel forklifts eligible for Carl Moyer Program funding and are subject to all off-road project criteria. The district must obtain and verify documentation of the classification of the forklift prior to funding. Class 7 forklifts typically have a lift capacity of over 6,000 pounds, pneumatic tires, and internal combustion, compression ignition engines powered almost exclusively by diesel. Many of the characteristics of these forklifts, including pneumatic tires for rough terrain, make them exclusively for outdoor use.

A. New Purchase

For most engine categories, the current standard is Tier 2 or Tier 3 with an optional Blue Sky Standard that applies through Tier 3. However, at this time, no engines have been certified to the Blue Sky standard. New equipment having an engine that was certified to any FEL level is not eligible for new purchase in the Carl Moyer Program. This is because the emission level from an eligible FEL engine in the new equipment would be considered to be at the level of the required emission standard for that engine, through the averaging provision of the ABT program discussed previously. Therefore,

the emissions from an FEL engine in the new equipment would not be surplus when compared to the emissions from a new engine meeting the required emission standards.

For some off-road equipment such as yard tractors, it may be possible to purchase new equipment with a new on-road engine certified to ARB's optional NOx emission credit standard instead of a new off-road engine. Where this is the case, emission benefits relative to the baseline engine are calculated based on on-road engine emission factors. If an applicant provides ARB with documentation showing that in past practice, the fleet has been powered by off-road engines, then the baseline emission may be calculated using the off-road engine emission factors.

B. Repower

Replacement of the in-use engine (i.e., repower) with an emission-certified engine instead of rebuilding the existing engine to its original uncontrolled specifications is the most common type of off-road project. Although this is commonly a diesel-to-diesel repower, significant NOx and PM benefits are achieved due to the high emission levels of the uncontrolled engine being replaced. Eligible engines are those that are certified to the current applicable emission standard or to an optional credit emission standard. For off-road equipment with similar modes of operation to on-road vehicles, other possible options include the replacement of an older uncontrolled diesel off-road engine with a new or rebuilt on-road engine certified to an emission standard equal to or lower than the Tier 2 off-road emission standard or a newer emission-certified alternative fuel engine.

ARB staff proposes that the Carl Moyer Program Guidelines require repower with a newer engine meeting current applicable emission standards (i.e., Tier 2 or Tier 3). If this is not a technical or practical option, as determined by the engine manufacturer, a newer emission-certified engine that meets the Tier 1 standards may be used. Off-road CI engines have undergone major design changes to meet new and more stringent emission regulations. Off-road engine manufacturers have made significant hardware modifications in order to meet the Tier 2 emission standards for engines with horsepower rating of 100 hp and greater. The incorporation of air-to-air aftercoolers and other auxiliary systems have resulted in Tier 2 engines for some applications that are physically different than the earlier Tier 1 engines. As a result, some existing equipment cannot accept Tier 2 engines without extensive modifications. This may involve cutting the equipment frame to gain adequate space for the Tier 2 engine. In these situations, technical, cost, and safety considerations make a new Tier 2 engine repower infeasible. Thus, the use of a newer emission-certified engine meeting the earlier Tier 1 emission standard may be justified. Specific information on the eligibility of these projects is further described in the project criteria.

In addition, ARB staff is proposing to require that all repower projects funded by the Carl Moyer Program install a retrofit device if one is available. ARB staff is proposing to require that the highest level ARB-verified retrofit device be installed for retrofit projects

if the project meets the cost effectiveness limit of $14,300 per weighted ton. If a Level 3 device is not feasible or does not meet the cost-effectiveness limit, a Level 2 device must be installed; if no Level 3 or Level 2 devices are feasible a Level 1 device must be installed. Due to limited current availability of retrofit devices for off-road engines it is likely that a retrofit will not be available in the near term. Repower projects would not be disqualified from participation in the Carl Moyer Program if retrofit devices are not feasible or if the cost of the available retrofit places the project over cost-effectiveness limit.

Funding is not available for projects where a spark-ignition engine (i.e., natural gas, gasoline, etc.) is replaced with a diesel engine.

C. Retrofit

Retrofit refers to modifications made to an engine and/or fuel system such that the specifications of the retrofitted engine are not the same as the original engine, please refer to Appendix F for more detailed information. The most straightforward retrofit projects are add-on after treatments. Other retrofits include upgrades of components that can be accomplished at the time of engine rebuild and result in a lower emission configuration. To qualify for Carl Moyer Program funding, the retrofit technology must be verified for sale in California and must comply with established durability and warranty requirements. Retrofits are verified for diesel PM reductions of: Level 1 - 25 percent, Level 2 - 50 percent, and Level 3 - 85 percent. Although retrofit technology options for off-road diesel engines are limited, it is possible that retrofit technologies that have been used to reduce NOx and PM emissions from on-road heavy-duty diesel engines may be used to control off-road engine emissions in some applications. More information on DECS, including a list of currently verified DECS, may be found at http://www.arb.ca.gov/diesel/verdev/verdev.htm.

V. Proposed Project Criteria

Participating districts retain the authority to impose more stringent additional requirements in order to address local concerns.

A. General

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding with a regulatory agency, settlement agreement, mitigation requirement, or other legal mandate.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + PM10 reduced, calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to satisfy any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging, banking, and trading program.

- Carl Moyer Program grants can be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including, but not limited to, tax credits or deductions, grants, or other public financial assistance.

- Projects must have a minimum project life of three years. ARB may approve shorter project life in writing for good cause on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The contract term must extend to the end of the project life.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the air district suggests potential surplus, real, quantifiable and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

- The certification emission standard and Tier designation for the engine must be determined from the Executive Order issued for that engine, not by the engine model year.

- Reduced-emission engines or retrofits must be certified/verified for sale in California and must comply with durability and warranty requirements. These may include new ARB certified engines, ARB certified after-market part engine/control devices, and verified diesel emission control strategies.

- Engines participating in the ABT program that are certified to FELs higher than the applicable emission standards, as designated on the Executive Order, are ineligible to participate in the Carl Moyer Program.

- Equipment manufactured under the "Flexibility Provisions for Equipment Manufacturers", as detailed in Title 13, CCR, section 2423(d), are ineligible for Carl Moyer funding.

- Engines that are participating in the "Tier 4 Early Introduction Incentive for Engine Manufacturers" program, as detailed in Title 13, CCR, section 2423(b)(6), are ineligible for Carl Moyer funding.

- Auxiliary engines on mobile equipment are eligible for Carl Moyer funding through January 1, 2007 if they are an integral part of the vehicle's or vessel's main function and are not covered by any district rule.

- Class 7 diesel forklifts are the only diesel forklifts eligible for Carl Moyer funding and are subject to all off-road project criteria. The district must obtain and verify documentation of the classification of the forklift prior to funding.

- Funded projects must operate at least 75 percent of total equipment operation hours in California.

- Default project life

Off-road new purchase	10 years
Off-road repower	7 years
Off-road repower and retrofit	5 years
Retrofit	5 years

Applicants must provide documentation to justify a longer project life.

B. New Purchase

- Engines must be certified to an ARB optional NOx or NOx+NMHC emission credit standard for off-road diesel engines that is at least 30 percent lower than current applicable emission standards or for some equipment, such as yard tractors, an on-road engine certified to ARB's optional NOx emission credit standard

- Engines that are certified to FEL levels are not eligible for funding in new equipment purchase projects.

C. Repower

- For repower projects that replace uncontrolled engines in existing equipment, the replacement engine must be certified to either: 1) the current applicable emission standard except as noted below, 2) to a FEL NOx or NOx+NMHC level that is lower than the required emission standard, or 3) to an optional credit emission standard as applicable for the horsepower rating.

- For equipment repower projects that replace emission-certified engines in existing equipment, the replacement engine must be certified to a NOx emission standard that is at least 15 percent lower than the emission standard(s) applicable to the existing engine.

- Engines used in equipment repower projects may be new, emission-certified rebuilt, or emission-certified remanufactured units. Eligible rebuilt or remanufactured engines are those offered by the original equipment manufacturer (OEM) or by a non-OEM rebuilder who demonstrates to the ARB that the rebuilt engine and parts are functionally equivalent from an emissions and durability standpoint to the OEM engine and components being replaced. Rebuilt and remanufactured engines that are not re-certified to new emission standards shall use the emission standards associated with the original engine block.

- ARB strongly recommends that districts give priority to Tier 2 or Tier 3 repowers. However, ARB recognizes that in some cases repower with the current applicable standard is not possible. In these cases a Tier 1 repower may be allowed if the conditions below are met and the project meets a project cost-effectiveness cap of $6,000 per weighted ton of emission reductions for the repower portion of the project. Tier 1 repowers of specialty equipment not meeting the project cost-effectiveness cap may be allowed on a case-by-case basis.

- If repower with an engine meeting the current applicable standard is technically infeasible, unsafe, or cost prohibitive, the replacement must meet the most current practicable previously applicable emission standard. The district shall determine eligibility of a Tier 1 engine repower project on a case-by-case basis by obtaining a Tier 2/Tier 3 repower exemption using one of the two following methods:

    1. The Carl Moyer Program application may include a written statement of reason(s) from the engine manufacturer verifying that a particular piece of equipment cannot accommodate an engine meeting current standards without major modifications, safety risks, or exorbitant cost. The letter must include information on the equipment being repowered, the engine being replaced, the reason why an engine meeting the currently applicable standard cannot be used (including details on required equipment modifications with pictures of the equipment, engineering drawings as necessary, and cost for the Tier 2/Tier 3 engine), and the proposed Tier 1 replacement engine. Districts must submit the written statement of reason(s) to ARB as an attachment to the annual report.

    2. The engine manufacturer may provide ARB with sufficient information on engine and/or equipment models for which Tier 2/Tier 3 repowers are available, and engine and/or equipment models for which Tier 2/Tier 3 repowers are not feasible. Engine manufacturers who are interested in pursuing this option should contact ARB. ARB staff will maintain a list of such engines and/or equipment models and make that list available to district staff.

- If an ARB-verified diesel emission control strategy is available for the replacement engine, ARB requires installation of the retrofit verified to the highest level which still meets the cost-effectiveness limit of $14,300 as discussed in the retrofit section of these project criteria.

- For repowers of equipment with baseline engines manufactured under the flexibility provision, as detailed in Title 13, CCR, section 2423(d), baseline emission rates shall be determined by using the latest applicable Tier emission standard for that engine model year and horsepower rating. Alternative emission rates will be allowed with documentation of the actual emission rates from the manufacturer based on the engine serial number. Districts must submit all documentation to ARB as an attachment to the annual report.

- Replacement of an uncontrolled diesel off-road engine with a new or rebuilt on-road engine certified to an emission standard equal to or lower than the Tier 2 off-road emission standard or a newer emission-certified alternative-fuel engine is eligible for funding in off-road equipment with similar modes of operation to on-road vehicles. Other equipment may be eligible for funding on a case-by-case basis. These repowers must meet all other applicable project criteria.

D. Retrofit

- Only ARB-verified retrofits are eligible for funding. Emerging engine retrofits will become eligible for Program participation once ARB grants verification for sale in California. Non-verified technologies may be considered on a case by case basis if: 1) an application for verification of the retrofit or add-on equipment on the proposed engine category is pending or 2) for highly specialized equipment where it is unlikely that a retrofit would be verified.

- Retrofit projects that control PM must use the highest level ARB-verified technology available for the equipment being retrofitted. The following are the diesel PM reductions for each verified level:
  - Level 1 - 25 percent;
  - Level 2 - 50 percent; and
  - Level 3 - 85 percent.

- Retrofit projects that control NOx must reduce NOx emissions from uncontrolled engines to the current applicable emission standard. If this is not feasible, the project must reduce NOx to at least the applicable Tier 1 NOx emission level (6.9 g/bhp-hr or lower). For emission-certified engines, the retrofit technology must be able to reduce NOx emissions by at least 15 percent.

- The cost of the retrofit, filters, and maintenance of the retrofit device needed during the project life may be paid for with incentive funding provided it meets the cost-effectiveness limit.

E. Scrap

- A baseline engine in a repower project must be destroyed by scrapping or drilling a hole in the engine block rendering it inoperable unless prior approval for alternate disposition has been granted by ARB staff. At the discretion of the district, core charges are eligible for funding and, if including, must be part of the cost-effectiveness calculation.

VI. Cost-Effectiveness

Emission reduction benefits represent the difference in the emission levels of the existing baseline technology relative to the newer, reduced-emission technology. Baseline and reduced engine emission factors are listed in Table B-12 in Appendix B. These factors reflect preliminary emission data based on model input values to the OFFROAD emission inventory model for engines greater than or equal to 25 hp.

A detailed description of how to calculate cost-effectiveness can be found in Appendix C. Off-road emission reduction calculations will use either the fuel or hour based formula as discussed Appendix C. The equipment activity level must be based on actual hours reading from an hour-meter or other similarly appropriate documentation provided by the applicant (i.e. fuel receipts). Future annual hours of equipment operation for determining emission reductions must be based only on readings from an installed and fully operational hour-meter. A properly functioning hour-meter is required to support equipment activity information included in the application for Carl Moyer Program funding. See the Administrative Part of the Guidelines for additional information on this topic. In addition, specific cost-effectiveness criteria and sample calculations for off-road projects may be found in Section V of Appendix D.

VII. Minimum Project Requirements

These are minimum project application requirements; the district has full authority to require additional application, reporting, monitoring, and scrapping requirements.

A. Application

Districts solicit bids for reduced-emission projects from off-road diesel equipment operators. The applicant must provide the minimum information illustrated in Table 5-3 below.

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are

coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Table 5-3
Minimum Application Information for Off-road CI Projects

Air District	
Applicant Demographics Company Name Business Type Mailing Address Location Address Contact Number	Replacement Engine Information Serial number Horsepower rating Engine make Engine model Engine year Tier (engine standard) Fuel type Executive Order reference
Project Description Project Name Project Type Equipment Function	Cost Effectiveness Analysis Basis: (choose one) Annual Diesel Gallons Used Annual Hours of Operation (must have hour meter installed)
Application: (Repower, Retrofit or New Purchase)	
Retrofit Technology Product name Executive Order reference Percent PM reduction Percent NOx reduction	Incremental Cost: Repower: Cost ($) of the existing engine (rebuild cost) Cost ($) of certified replacement engine
Percent Operated in California:	New Purchase: Cost ($) of the required certified emission equipment Cost ($) of the certified lower emission equipment
Project Life (years)	
Existing Engine Information Serial number Horsepower rating Engine make Engine model Engine year Tier (if applicable) Fuel type	Retrofit: Cost ($) of retrofit kit Dollar amount of additional financial incentives District Incentive Amount Requested

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts

are encouraged to provide technical assistance to applicants in completing the application.

B. Reporting and Monitoring

Districts must abide by all reporting and monitoring requirements described in Part I-Program Administration. Monitoring of project progress ensures that the vehicle or engine is operated as stated in the program application. Fleet operators and transit agencies participating in the Carl Moyer Program are required to keep appropriate records during the life of the funded project. Records must be retained and updated for the duration of the project life and made available at the request of the district or ARB.

IV. References

ARB, 2000. Staff Report: Initial Statement of Reasons. Public Hearing to Consider Amendments to Off-road Compression-ignition Engine Regulations: 2000 and Later Emissions Standards, Compliance Requirements and Test Procedures. http://www.arb.ca.gov/regact/ciengine/isor.pdf

ARB, 2004a. Staff Report: Initial Statement of Reasons. Proposed Amendments to the regulation for Statewide Portable Equipment Registration Program. http://www.arb.ca.gov/regact/portreg/isor.pdf

ARB, 2004b. Staff Report: Initial Statement of Reasons. Public Hearing to Consider Amendments to the California Off-road Emissions Regulations for Compression-ignition Engines and Equipment. http://www.arb.ca.gov/regact/offrdcie/isor.pdf

Chapter Six

LARGE SPARK-IGNITION OFF-ROAD EQUIPMENT

Due to the upcoming regulations for large spark-ignition (LSI) equipment that include forklifts, this chapter has been added to replace the Forklift Chapter in the 2003 Guidelines. This revision of the Guidelines expands funding opportunities from only forklifts to all LSI equipment types. The chapter provides an overview of off-road LSI equipment and discusses the emissions from LSI equipment, the State and federal emission standards, and potential types of projects eligible for funding.

The Carl Moyer Program funds projects that provide emission reductions that are surplus to any regulation. Because proposed regulations for LSI equipment are scheduled for consideration by the Board, staff will provide specific criteria to districts through a technical advisory approved by the Executive Officer once the Board has approved the proposed regulations.

In the interim, districts may continue to use the 2003 Carl Moyer Program Guidelines to fund projects or request consideration of other projects on a case-by-case basis.

I. Introduction

LSI engines are typically derived from automobile engines and are most commonly fueled by gasoline or liquefied petroleum gas. A small number are fueled by compressed natural gas (CNG), and some have dual fuel capability. Off-road LSI equipment includes the following types of equipment: large turf care equipment, scrubber/sweepers, airport service vehicles, and a variety of other agricultural, construction, and general industrial equipment. The largest group of LSI equipment in California is forklifts, representing almost half of the LSI inventory.

The U.S. Environmental Protection Agency (U.S. EPA) has sole authority to regulate new farm and construction equipment less than 175 hp. However, the Air Resources Board (ARB) has authority to regulate off-road equipment equal to or greater than 175 hp, and all in-use off-road equipment and non-preempted off-road equipment less than 175 hp.

II. Emissions

Uncontrolled LSI engines can emit more than 12 grams per brake horsepower-hour (g/bhp-hr) of oxides of nitrogen plus hydrocarbons (NOx + HC). Statewide, the NOx + HC emissions from LSI equipment are approximately 70 tons per day.

The equipment categories shown in Table 6-1 represent the largest contribution to the overall off-road LSI inventory and are the focus of the proposed LSI regulation. Although these three categories account for only 60 percent of the off-road LSI

equipment population in 2004, they account for more than 80 percent of the NOx + HC off-road LSI emission inventory. As shown in Table 6-1, most of those emissions are from forklifts, 80 percent of which are in large fleets.

Table 6-1
Statewide Emissions from Off-Road LSI Equipment
(tons per day)

Equipment Category	2004		2010		2020	
	NOx	ROG	NOx	ROG	NOx	ROG
Industrial Forklifts	40.4	11.8	19.9	5.3	15.6	3.4
Airport Ground Support Equipment	3.3	0.6	1.5	0.3	1.0	0.2
Sweeper/Scrubbers	0.8	0.2	0.3	0.1	0.2	0.1
Total	44.5	12.6	21.7	5.7	16.8	3.7

III. Regulatory Requirements

A. Emission Standards

In 1998, the ARB adopted LSI regulations that addressed the State's obligations under the 1994 State Implementation Plan (SIP). The SIP is California's federally required plan describing how the State will reduce emissions and meet federal clean air standards.

That regulation required all new LSI engines over 25 horsepower sold in California to be certified to a standard of 3.0 g/bhp-hr of NOx + HC. This was to be phased in from 2001 to 2004. In 2002, U.S. EPA adopted a more stringent standard requiring that new LSI engines meet a 2.0 standard of g/bhp-hr of NOx + HC beginning in 2007.

B. Proposed Regulation

In order to achieve California's clean air goals, the 2003 SIP calls for further reductions from new and in-use LSI engines.

1. Emission Standards

The ARB staff has developed a proposal that would provide more low emission options for equipment purchases. Staff is proposing to require 2007 model year engines to meet a 2.0 g/bhp-hr standard and 2010 and subsequent model year engines to meet a 0.6 g/bhp-hr standard. ARB staff is also proposing NOx + HC optional standards so that new 2007 engines can be certified to 0.1, 0.2, 0.4, 0.6, 1.0, and 1.5 g/bhp-hr. For model years 2010 and beyond, new engines could be certified to 0.1, 0.2, and 0.4 g/bhp-hr.

2. Fleet Rules

As part of the staff proposal, equipment fleets would have to meet average emission requirements. Large and mid-size fleets of forklifts, airport ground support equipment (GSE), sweeper/scrubbers (with a displacement greater than one liter), and non-GSE industrial tow tractors would have specific emission averages to meet.

Table 6-2 lists the proposed standards required of manufacturers as well as proposed compliance dates for fleets. The proposed averages that fleets would be required to meet would be based on the total number of pieces of equipment in the fleet. Equipment with hour-meters documenting usage of less than 251 hours per year would be exempt from the fleet average emission level requirements.

Table 6-2
Current and Proposed Emission Standards and Fleet Average Requirements
(g/bhp-hr of NOx + HC)

LSI Fleet Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2016
current standards (CA and U.S.EPA)	3.0		2.0							
proposed standards	3.0		2.0			0.6				
proposed optional standards	0.1, 0.2, 0.4, 0.6, 1.0, and 1.5					0.1, 0.2, and 0.4				
proposed fleet average large fleet forklift					2.4	2.4	1.7	1.7	1.1	1.1
proposed fleet average mid-size fleet forklift					2.6	2.6	2.0	2.0	1.4	1.4
proposed fleet average non-forklift					3.0	3.0	2.7	2.7	2.5	2.5
proposed fleet average small fleet							3.0			
proposed fleet average ground support equipment					3.0					
proposed agricultural crop preparation services fleets		12	11.1	10.2	9.3	8.4	7.5	6.6	5.7	3

IV. Potential Projects

The ARB encourages replacement of LSI equipment with zero-emission equipment where feasible. Information about zero-emission strategies is provided in Chapter 12. Below are brief descriptions of potential projects. Off-road projects fall into three categories: 1) new purchase of an emission certified engine, 2) repower with an emission certified engine, and 3) retrofit with ARB-verified technology.

A. New Purchase

New or expanding facilities purchasing LSI equipment with engines that are certified to 30 percent below the current standard may qualify for funding if the emission reductions are shown to go beyond any regulatory requirement and the any LSI regulating that are adopted by the Board. This could be accomplished by purchasing equipment that is electric or certified to an optional low emission standard.

These projects are eligible for Carl Moyer Program funding if the project exceeds regulatory requirements. Since replacing an older electric forklift with a newer electric model would not reduce emissions, projects with "electric to electric" replacements are excluded. Purchase of new CNG LSI equipment may also be eligible if it is certified to meet optional low emission standards.

B. Repower

Repower refers to the replacement of an existing engine with a newer engine certified to lower emission standards. This is an alternative to rebuilding an existing engine to the original higher emitting specifications the existing engine. The certified engine must include all the emission controls components as stated in the Executive Order for that engine. There may be some limits to repowering of LSI equipment because installing a newer engine design into existing equipment may not always be feasible. The baseline emissions for these projects would be the emission rate of the existing engine. The baseline cost would be the cost to rebuild. Repower projects may qualify for funding if the emission reductions are shown to go beyond any regulatory requirement and the LSI regulation adopted by the Board. Repowers of certified engines must provide at least a 15 percent emission reduction from the baseline engine and repowers of uncontrolled engines must meet the current emission standard.

C. Retrofit

Retrofit refers to modifications or additions made to an engine and/or fuel system such that the specifications of the retrofitted engine are not the same as the original engine. Data has shown that existing LSI engines retrofitted with closed loop, catalyst-based emission systems could achieve emission reductions similar to those achieved from new engines designed with catalysts. Retrofits for LSI equipment will likely incorporate advanced automotive-inspired emission control technologies that dramatically reduce emissions while meeting operational requirements. (See Appendix F for more discussion on retrofits.) This technology has been in use for about 10 years nationwide on a variety of LSI equipment. Usually a retrofit would be installed at the time of engine rebuild or a regularly scheduled maintenance. To qualify for Carl Moyer Program funding, the retrofit technology must be verified for sale in California. The ARB has an interim verification procedure for manufacturers of retrofit systems for LSI equipment.

To be eligible to receive Carl Moyer Program funds, emission reductions must go beyond any legally-binding requirement and the LSI regulation adopted by the Board.

Typically under the Carl Moyer Program, retrofit projects are allowed if they provide at least 15 percent reductions in emissions. However, under the proposed LSI regulations only retrofits that reduce emissions by 25 percent or more will be verified. Hence, only retrofits that reduce emissions on uncontrolled LSI engines by 25 percent would be for Carl Moyer Program funding. Retrofit systems for installation on emission-certified engines must by verified to no more than 2.0 g/bhp-hr of NOx+HC. The eligible cost would be the kit and installation costs.

Since nearly half of the LSI equipment in California is forklifts, some information on forklift classes is presented below. The Industrial Truck Association (ITA) has defined seven classes of forklifts. These classes are defined by the type of engine, work environment (indoors, outdoors, narrow aisle, smooth or rough surfaces), operator positions (sit down or standing), and equipment characteristics (type of tire, maximum grade, etc.). Several classes are further divided by operating characteristics. Classifications are described in Table 6-3.

Table 6-3
Forklift Classes

Class	Lift Code	Engine Type	Type/Use
1	1	Electric	Counterbalanced rider, stand up
1	4		Three-wheel, sit down
1	5		Counterbalanced rider, sit down
1	6		Counterbalanced rider, sit down
2			Narrow aisle truck
3			Hand or hand/rider truck
4		Internal Combustion	Rider, sit down, generally suitable for indoor use on hard surfaces
5			Rider, sit down, typically used outdoors, on rough surfaces or steep inclines
6		Internal combustion and Electric	Ride on unit with the ability to tow at least 1,000 pounds; designed to tow cargo rather than lift it (e.g. an airport tug)
7		Internal combustion (primarily diesel)	Rough terrain forklift truck for outdoor use; almost exclusively powered by diesel engines

Class 1 forklifts (lift codes 5 and 6) can be used in many of the same work applications as the class 4 or 5 forklifts because they are similar in design and specification. Increasing the use of class 1 forklifts relative to class 4 and 5 forklifts would reduce NOx emissions of the fleets.

Class 6 trucks are ride-on vehicles designed to tow at least 1,000 pounds. Airport tugs are an example of a Class 6 truck. See Chapter 7 for a description of GSE and additional information about the South Coast Ground Support Equipment Memorandum of Understanding that may limit project eligibility for LSI equipment used in airport ground support fleets.

Class 7 consists of rough terrain forklifts for outdoor use. See Chapter 5 for project funding criteria for Class 7 forklifts which are usually powered by diesel engines.

V. Proposed Project Criteria

Since all Carl Moyer Program projects must be surplus to any regulations, specific project criteria that define project eligibility for the LSI source category must be based on LSI regulations that are adopted by the Board. After Board approval of the LSI regulation, staff will develop criteria for those projects that provide emission reductions beyond the approved regulatory requirements. Staff recommends that the Board grant the Executive Officer the authority to approve LSI project criteria in a technical advisory. In the interim, forklift purchases and retrofits would be allowed as approved under the 2003 Carl Moyer Program Guidelines. Staff is proposing that until the Board adopts the LSI regulation, districts may continue to use the 2003 Guidelines in evaluating projects. During this interim period additional LSI projects may be considered on a case-by-case basis.

On September 6, 2005, Governor Schwarzenegger signed Senate Bill 467 (Lowenthal) which requires the ARB to revise the Carl Moyer Program Guidelines to include projects in which an applicant turns in off-road equipment powered by an internal combustion engines and replaces that equipment with new zero-emission technologies. This legislation will take effect on January 1, 2006. ARB staff will evaluate how to incorporate the requirements of this legislation into the Carl Moyer Program in 2006.

Chapter Seven

AIRPORT GROUND SUPPORT EQUIPMENT

This chapter describes the airport ground support equipment (GSE) category under the Carl Moyer Program. It also gives a brief overview of the requirements for fleets. It discusses different types of equipment, current emission standards, available control technology, and potential incentive projects eligible for funding.

All Carl Moyer Program projects must be surplus to any regulation. Because regulations for GSE equipment with spark-ignition engines are currently scheduled for consideration by the Board in late 2005, this chapter does not present criteria districts would use in selecting a project to fund. Staff proposes to present specific criteria to districts through a technical advisory approved by the Executive Officer once the Board has approved the proposed regulations for large spark ignited (LSI) equipment. In the interim, projects would be allowed as approved under the 2003 guidelines.

I. Introduction

Airport vehicles and ground support equipment are used to transport passengers as well as baggage and freight, to support maintenance and repair functions, and to provide power to various service functions. Airport GSE includes aircraft pushback tugs, baggage and cargo tugs, carts, forklifts and lifts, ground power units, air conditioning units, belt loaders, and other equipment. Vehicles and equipment at airports fall into two broad categories. Land-side vehicles and equipment are used on the passenger/entry side of the airport. Air-side vehicles are used principally (at least half of the time) on the tarmac. For the purposes of the Carl Moyer Program, this airport GSE chapter is only to be used to evaluate air-side equipment. Land-side vehicles and equipment may be considered under the on-road vehicles (Chapter 1) and off-road vehicles and equipment (Chapters 5 and 6) project criteria of the Carl Moyer Program.

Airport GSE is typically powered by gasoline, diesel or propane. Airport GSE can also be powered by electric motors having zero exhaust emissions. Electric GSE is commercially available from a number of manufacturers, and interest in the use of electric equipment is increasing. Currently, there are no federal or California regulations that require the use of electric GSE. There are airports throughout the United States, however, with a very high percentage of electric GSE. For example, Denver International Airport was designed for all electric GSE. Also, Logan International Airport in Boston has made considerable progress in switching to electric GSE equipment.

Airport GSE are used from the moment an aircraft lands until it takes off. GSE perform a variety of functions such as towing, powering, and servicing aircrafts. There is great diversity in the type of equipment used, as well as in the variety of engines that power GSE. Table 7.1 below lists the commonly used types of GSE. Airport GSE can be owned by airlines, airports, cargo handlers, mail and parcel companies or management

companies. Most airlines own or maintain the GSE they use, or have full service leasing from equipment management companies. Airports usually own the buildings and other stationary infrastructure on site and lease them to the airlines. The installation and cost of improvements, including electric equipment and vehicle infrastructure, are usually subject to the approval of the airport's property management. Costs can either be borne by the airport or passed on to the airlines. There is also a growing trend for airports to own the ground power units and charge the airlines for the time of usage.

Table 7-1
Types of Airport GSE

Baggage Tug
Belt Loader
Forklifts, lifts & cargo loaders
Ground Power Unit
Aircraft Tug (narrow & wide body)
Airstart Unit
Air Conditioner
Deicer
Cart & Lavatory Cart
Fuel Trucks
Utility Trucks (lavatory, maintenance, water & service)
Bobtail

II. Regulatory Requirements

The United States Environmental Protection Agency (U.S. EPA) and ARB have adopted emission standards that will be phased in for new GSE equipment powered by off-road internal combustion (IC) engines. Internal combustion engines used in GSE can be powered by either compression-ignition (CI or “diesel”) engines or by spark-ignition (SI) engines using gasoline, compressed natural gas (CNG), or propane fuel. GSE is regulated under ARB and U.S. EPA's emission standards for off-road equipment.

ARB has the authority to regulate new off-road CI equipment equal to or greater than 175 hp and non-preempted off-road CI less than 175 horsepower. In January 1992, the Board adopted exhaust emission standards for off-road diesel engines 175 hp and greater, effective beginning with 1996 model year engines.

In August 1996, the U.S. EPA, ARB, and off-road diesel engine manufacturers signed a Statement of Principles, which established a progressive set of emission standards and called for harmonization of ARB and U.S. EPA off-road diesel engine regulations. The U.S. EPA adopted emission standards in 1998 and again in 2004 that provided for new oxides of nitrogen (NOx) + non-methane hydrocarbons (NMHC), PM, and carbon monoxide (CO) emission standards for engines within different power categories to be

effective in a tiered approach, commonly referred to as Tier standards. ARB has since amended the California exhaust emission standards for off-road diesel engines (originally adopted in 1992) to include non-preempt engines below 175 horsepower and to harmonize with the federal requirements. Please refer to Chapter 5 of the Guidelines (Compression-Ignition Off-Road Equipment) for more discussion on these requirements.

In 1998, the ARB adopted regulations for off-road LSI engines sold in California. The regulations require new LSI engines 25 horsepower and greater to be certified to an emission standard of 3.0 g/bhp-hr of NOx+HC. This standard was phased in between 2001 and 2004. The U.S. EPA followed in 2002, adopting the same NOx+HC standard beginning in 2004. At the same time, the U.S. EPA also adopted a standard of 2.0 g/bhp-hr NOx+HC, beginning in 2007. ARB is currently developing a proposal that includes new emission standards and fleet requirements for LSI engines and equipment. This proposal is scheduled for Board consideration in late 2005 and would govern the development of project criteria for GSE. Please refer to Chapter 6 of the Guidelines (Off-Road Large Spark Ignition Equipment) for more discussion on the off-road LSI equipment category and emission requirements.

In 2002, the ARB and several airlines entered into a Memorandum of Understanding (MOU) aimed at introducing cleaner GSE, with an emphasis on electric GSE, into the South Coast Air Basin. Under the agreement, all major airlines operating at five airports in the South Coast Air Basin (LAX, Ontario, Orange County, Burbank, and Long Beach) would begin to incorporate lower-emission GSE into their fleets. GSE projects that are surplus to the emission reductions required under the MOU are eligible for funding under the Carl Moyer Program.

III. Potential Projects

A cost-effective strategy to reduce emissions involves the purchase of electric GSE, which has no exhaust emissions. Electric GSE is commercially available for a number of equipment types, including belt loaders, baggage tractors, aircraft tugs, lifts, and ground power units. Several airlines and airports have conducted electric GSE demonstration programs and fleet conversion programs. Further discussion of electric GSE experiences can be found in Chapter 12 of the Guidelines and a report by Arcadis, Geraghty & Miller [ARB, 1999].

Airport GSE emissions can also be decreased by retrofitting the equipment with a PM filter, diesel oxidation catalyst or a three-way catalyst. For instance, catalysts have been added to SI GSE to meet the current LSI emission standards. In addition, to reduce emissions GSE can be repowered with a new, cleaner IC engines.

The Carl Moyer Program will fund the purchase of electric GSE, as well as GSE repower and retrofit projects if this equipment is not subject to any existing or planned regulations, funded through another incentive program, or used to generate credits of any type. In addition, projects that are surplus to the emission reductions required under the South Coast MOU are eligible for funding. The most promising categories are those

where electric equipment has been used and demonstrated and are readily available from commercial vendors. This includes electric baggage tugs, belt loaders, and aircraft tugs. These equipment categories also represent a significant portion of the statewide GSE population and have some of the highest average annual hours of usage. Purchase of electric GSE instead of IC-engine GSE would yield significant emission benefits. Therefore, the Carl Moyer Program guidelines would continue to target these categories. Other promising projects include lifts and cargo loaders. Carts, lavatory carts and air-start units each represent a smaller fraction of the GSE equipment inventory. Fuel, utility, water, and service trucks are not covered under the current airport GSE guidelines, but may be considered under the on-road vehicle category (Chapter 1).

IV. Proposed Project Criteria

Since potential GSE projects could involve either CI or SI engines, eligibility criteria for GSE would be dependent on the base engine of the GSE and any regulatory requirements, including fleet requirements, applicable to the GSE category. For projects involving CI GSE, please refer to Chapter 5. Note that in addition to meeting the project criteria for off-road CI equipment, GSE projects applied for by the participating airlines in the GSE MOU must also be surplus to the MOU. For LSI GSE, specific project criteria will be developed based on the outcome of the proposed regulation for LSI engines and equipment currently scheduled for Board's consideration in late 2005. Staff recommends that the Board grant the Executive Officer authority to approve GSE project criteria in a Carl Moyer Program advisory. Staff proposes that until the Board adopts the upcoming LSI regulation, districts may continue to fund GSE projects using the 2003 Carl Moyer Program Guidelines. In addition, airport GSE used at non-commercial airports would be eligible for funding. During this interim period, additional GSE projects may be considered on a case-by-case basis.

Airport GSE projects funded by the Carl Moyer Program must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in the Guidelines.

On September 6, 2005, Governor Schwarzenegger signed Senate Bill 467 (Lowenthal) which requires the ARB to revise the Carl Moyer Program Guidelines to include projects in which an applicant turns in off-road equipment powered by an internal combustion engines and replaces that equipment with new zero-emission technologies. This legislation will take effect on January 1, 2006. ARB staff will evaluate how to incorporate the requirements of this legislation into the Carl Moyer Program in 2006.

V. References

ARB, 1999. Assessment of Airport Ground Support Equipment Using Electric Power or Low-Emitting Fuels (Final Report), Final Report to Air Resources Board. Arcadis Geraghty & Miller, July 20, 1999.

Chapter Eight

LOCOMOTIVES

This chapter presents program criteria for locomotive projects, and provides an overview of the locomotive industry, locomotive emissions, current emission control requirements, and types of incentive projects eligible for funding. The chapter also sets requirements for installation of an idle-limiting device (ILD) on project locomotives, defines criteria for hybrid and multiple engine technology switcher projects.

I. Introduction

Locomotives move more than 40 percent of the freight in the United States, on a ton-miles basis [Association of American Railroads, 2004]. Most locomotives operating today are diesel-electric, using a diesel engine to drive a generator, which in turn drives the locomotive wheels. Locomotive engines have very long useful lives, with the capability of being rebuilt numerous times.

Locomotives provide line-haul, short-haul, switcher, and passenger service. Each of these locomotive types has discrete functions and characteristics:

- Line Haul - Line-haul locomotives typically transport goods between major urban centers, sometimes up to 3,000 miles apart. Line-haul locomotives operate at higher speeds than other locomotives and generally utilize engines with 3,000 or greater horsepower. Because reliability is important for line-haul operators, these locomotives tend to be newer and well-maintained.

- Short-Haul - Short-haul locomotives perform a combination of line-haul and railyard service. Typically, they use 2,000 to 3,800 horsepower engines, and move freight regionally or locally. For the purposes of the Carl Moyer Program, short-haul locomotives are treated the same as line-haul locomotives.

- Switcher - Switch locomotives separate and move railcars from track to track or transfer cars to and from regional carriers. Typically, they use 1,500 to 2,300 horsepower diesel engines, travel short distances at low speeds, make numerous stops, and idle frequently for long periods of time. Switcher locomotives are generally remanufactured from aging line-haul locomotives. Switchers are typically the oldest and most poorly maintained locomotives.

- Passenger - Passenger locomotives haul passengers rather than freight, and are typically used in high speed, line-haul type operations. The average passenger train is about 10 years old and has a 3,000 to 3,600 horsepower engine.

II. Emissions

Locomotives are a significant source of oxides of nitrogen (NOx) and particulate matter (PM) emissions. Line haul and short-haul locomotives emit over 90 percent of locomotive Nox and PM emissions in California, while switchers and passenger locomotives are responsible for about six and two percent of locomotive emissions, respectively. Although switch locomotives generate less overall emissions than line-haul locomotives, their emissions tend to be concentrated at and around railyards, and can pose greater health concerns for nearby communities.

About 25 percent of the State's locomotive Nox and PM emissions occur in the Mojave Desert Air Basin (See Table 8-1, below). The bulk of these emissions are generated by the hauling of freight from the Ports of Los Angeles and Long Beach through Barstow to points east. Barstow is home to the second largest rail yard west of the Mississippi River; the largest is the Roseville Rail Yard in the Sacramento Valley. Locomotives in the South Coast Air Basin contribute about 20 percent of statewide emissions, while the locomotives in the San Joaquin Valley and Sacramento Valley each account for about 15 percent.

Table 8-1
Locomotive Emission Inventory
(Annual average tons per day in 2005)

Region	Nox	PM
Mojave Desert Air Basin	39	1.3
South Coast Air Basin	33	1.0
San Joaquin Valley	24	0.7
Sacramento Valley	23	0.7
Bay Area	11	0.3
Rest of the State	32	1.1
Total	**162**	**5.1**

Based on ARB's CCOS Emissions Inventory (Version 2.12)

III. Regulatory Requirements

The U.S. Environmental Protection Agency (U.S. EPA), with its sole authority to set emission standards for new and remanufactured locomotives, has adopted phased-in locomotive emission standards [Federal Register, April 16, 1998]. Federal locomotive emission standards contain two primary provisions: 1) remanufacture emission limits applicable to railroads whenever they remanufacture or rebuild their locomotive engines, and 2) emission standards for new locomotives applicable to locomotive manufacturers.

A. Locomotive Remanufacture Emission Standards

Regulation of remanufactured locomotives is critical because locomotives are generally remanufactured five to ten times during their service lives. U.S. EPA's locomotive remanufacture emission standards therefore provide a mechanism to reduce emissions from the existing fleet. Federal locomotive remanufacture emission standards require locomotives originally manufactured in 1973 or later to meet the emission limits listed in Table 8-2 whenever they are rebuilt or remanufactured. Locomotives originally manufactured before 1973 are exempt from the federal locomotive remanufacture requirements.

Table 8-2
Federal Exhaust Emission Standards for Locomotives
for New Engines and at Time of Remanufacture
(g/bhp-hr)

Duty-cycle	Gaseous and Particulate Emissions			
	HC	CO	NOx	PM
	Tier 0 (1973 – 2001 model years)			
Line-haul/ Passenger	1.00	5.0	9.5	0.60
Switcher	2.10	8.0	14.0	0.72
	Tier 1 (2002 – 2004 model years)			
Line-haul/ Passenger	0.55	2.2	7.4	0.45
Switcher	1.20	2.5	11.0	0.54
	Tier 2 (2005 and later model years)			
Line-haul/ Passenger	0.30	1.5	5.5	0.20
Switcher	0.60	2.4	8.1	0.24

U.S. EPA locomotive remanufacture requirements also include an exemption for small railroads -- line-haul railroads with fewer than 1,500 employees, and switch railroads with fewer than 500 employees. Surface Transportation Board (STB) freight railroad classifications, based on annual revenues, provide an equivalent mechanism for distinguishing between large and small railroads in California. STB freight and other railroad classifications, and the applicable U.S. EPA remanufacture requirements are as follows:

- Class I Railroads - Class I freight railroads are carriers with annual revenues greater than or equal to $266.7 million. Locomotives owned and operated by Class I railroads in California must meet the U.S. EPA remanufacture emission limits in Table 8-2. The Union Pacific Railroad (UP) and the Burlington Northern & Santa Fe Railroad (BNSF) are the only Class I freight railroad companies operating in California.

- Class II Railroads - Class II railroads are carriers with annual revenues between $21.3 and $266.7 million. Class II railroads are exempt from federal locomotive remanufacture requirements. Currently, there are no Class II railroads headquartered in California. For the purposes of the Carl Moyer Program, a Class II railroad locomotive must meet the same project criteria as a Class III railroad locomotive.

- Class III Railroads - Class III railroads are carriers with annual revenues less than $21.3 million. Class III railroads in California are largely exempt from federal locomotive engine remanufacture requirements. As a result, many older, unregulated locomotives continue to operate at Class III railroads.

- Military and Industrial Railroads – Over 100 military and industrial locomotives owned by non-railroad companies operate in California. These locomotives are generally much smaller in size and horsepower than locomotives used by larger rail yards, are confined to small yards or industrial plants, and are typically 40 to 60 years old. Military and industrial locomotives are largely exempt from federal locomotive remanufacture requirements. For the purposes of the Carl Moyer Program, military and industrial locomotives must meet the same project criteria as a Class III railroad locomotive.

- Passenger Service Railroads – Amtrak is California's only passenger locomotive operator not considered a small railroad by federal regulations. Amtrak is therefore the state's only passenger railroad subject to federal locomotive remanufacture requirements. Amtrak locomotives are currently required to meet all Tier 1 and Tier 2 emission limits, but are not subject to Tier 0 remanufacture requirements for their 1973 through 2001 model year locomotives until 2007.

The practical impact of the federal small railroad exemption from locomotive remanufacture requirements is that UP, BNSF, and Amtrak locomotives must meet federal remanufacture emission limits, while other railroads can remanufacture to uncontrolled emission levels.

B. Emission Standards for New Locomotives

The second component of federal locomotive standards took effect in 2000, applies to locomotive manufacturers, and requires all new locomotives to meet the tiered emission standards in Table 8-2. Because these standards apply to locomotive manufacturers, all railroads, regardless of size, must purchase locomotives meeting Tier 2 emission limits when purchasing a new locomotive. In practice, however, only Class I railroads purchase new locomotives, while Class III railroads typically purchase existing in-use locomotives.

C. Upcoming Regulations

In May 2004, U.S. EPA issued an Advanced Notice of Proposed Rulemaking, signaling its intent to pursue more stringent standards for new and existing locomotives [U.S. EPA, 2004]. The standards are likely to be modeled after 2007 and 2010 on-road and off-road diesel engine standards, and to be based on the application of catalytic after-treatment technology. The new locomotive standards could be phased in beginning as early as 2011.

D. South Coast Locomotive Memorandum of Understanding

The Air Resources Board (ARB or "Board") and U.S. EPA have signed an enforceable Memorandum of Understanding (MOU) with UP and BNSF railroads to implement a locomotive fleet average emissions program in the South Coast Air Basin (SCAB). The purpose of the South Coast MOU is to expedite the introduction of new, lower-emitting locomotive engines in the SCAB. The agreement commits UP and BNSF railroads to achieve a 5.5 g/bhp-hr locomotive fleet average NOx emission rate in the SCAB by 2010. The railroads can also get credit towards their 2010 fleet average target by exceeding the fleet average emissions targets between 2005 and 2009.

In order to ensure Carl Moyer Program funding achieves surplus emission reductions, railroads subject to the South Coast MOU must meet the following minimum project criteria:

- Locomotive projects in the SCAB may not be included in the MOU fleet average emission rate compliance demonstration.
- The project baseline emission rate for all locomotives in the SCAB subject to the South Coast MOU shall be equivalent to the Tier 2 emission rates identified for line-haul and switch locomotives in Table B-16.
- Locomotive projects in all air districts must have a minimum project life of ten years.

This last requirement helps ensure that a cleaner locomotive funded in another air district cannot be exchanged for a dirtier locomotive in the SCAB at the completion of the project life to demonstrate compliance with the South Coast MOU. Allowing such an exchange, even at the end of the project life, could result in higher overall emissions since the locomotive exchanged into the participating air district could be dirtier than the original project locomotive.

E. Statewide Locomotive Memorandum of Understanding

In June 2005, ARB signed a Statewide MOU with UP and BNSF railroads. The MOU requires UP and BNSF to install an ILD on over 99 percent of their intrastate locomotives between June 30, 2006 and June 30, 2008. The Statewide MOU also requires 80 percent of the diesel fuel dispensed to UP and BNSF locomotives in California to be low-sulfur diesel by the end of 2006. This agreement complements an ARB intrastate locomotive fuels regulation, adopted in November 2004, which requires

all intrastate diesel locomotives to use California reformulated low-sulfur diesel fuel by January 1, 2007. The Statewide MOU also requires that railroads conduct health risk assessments at California's rail yards and consider additional long-term strategies to reduce idling PM emissions and health risks. Because the Statewide MOU requires virtually all UP and BNSF locomotives have ILDs, ILD projects for UP and BNSF locomotives are not eligible for Carl Moyer Program funding. (*The Board will consider the Statewide Locomotive MOU at a October 27, 2005 Board meeting. ARB may update Carl Moyer Program criteria for Class I railroad ILD installation, if necessary, based upon this meeting*).

IV. Potential Projects

Projects eligible for Carl Moyer Program incentive funding include repower or retrofit of an existing locomotive engine, purchase of a new reduced-emission engine or locomotive, or installation of an ILD. Hybrid and multiple engine switch locomotive projects have also received Carl Moyer Program funding in recent years and are eligible for funding. Other technologies that offer real emission reductions may also be considered on a case-by-case basis. Funding for projects considered on a case-by-case basis shall be contingent on a clear demonstration that the project shall achieve surplus, real, quantifiable, and enforceable emission reductions.

A. Repower

Repowering involves replacing an existing locomotive engine with a newer, lower-emitting engine. Locomotive repower projects must achieve at least a 15 percent NOx reduction beyond existing emissions levels. Repower projects for 1973 and later year Class III locomotives must achieve at least Tier 0-equivalent emission rates if a remanufacture kit certified by U.S. EPA to meet Tier 0 or lower emission levels is available. Baseline emissions for locomotive repower projects reflect federal emission requirements for engine remanufacture (e.g. Tier 0 through Tier 2 emission rates for Class I locomotives, and uncontrolled emissions for pre-1973 locomotives and Class III locomotives). Baseline costs for repower projects reflect the cost to remanufacture the project engine or $50,000, whichever is greater.

B. Retrofits

Retrofits involve hardware modifications to the engine or exhaust system to reduce emissions. Potential retrofit projects involve the addition of an ARB-verified retrofit device, or installation of a U.S. EPA-certified remanufacture emission kit. For most Carl Moyer Program categories, a retrofit device must be ARB-verified in order to be considered for funding. To date, however, very few retrofit technologies have been verified to reduce emissions from a locomotive. Retrofit technologies generally develop first for on-road sources, and are refined for use on off-road engines. Because of the lack of retrofit devices verified for use on a locomotive engine, ARB will consider funding a locomotive retrofit device which is not yet ARB-verified for use on locomotives on a

case-by-case basis. Applicants for funding on a case-by-case basis must meet the applicable project criteria identified in Section V of this chapter.

In recent years, engine manufacturers have developed U.S. EPA-certified engine retrofit kits for use on locomotives. To be eligible for Carl Moyer Program funding, retrofit emission kits must be U.S. EPA certified to achieve at least Tier 0 locomotive emission standards on the project locomotive engine. Remanufacture emission kit projects must also achieve at least 15 percent NOx reductions from the project locomotive if taking credit for NOx emission reductions. Kits which utilize fuel injection timing retard must be clearly demonstrated to not increase in-use PM or HC emissions to be eligible for funding. Individual engine parts or other locomotive components are not eligible for funding except as part of a complete U.S. EPA certified engine retrofit kit.

C. Idle-Limiting Devices

Locomotive operators idle their engines to maintain battery charge, warmth of the engine coolant, fuel, oil, and water, and comfortable temperatures inside the operator cabs. Locomotives also idle to ensure the engine is readily available (avoiding unnecessary starting and shutting-down), and because of habitual practice. Installation of an ILD can significantly reduce emissions from locomotives, which typically spend 40 to 60 percent of their operating time in the idle duty cycle.

The ILD technologies on the market today vary in operational requirements and predictability of idling reductions. An automatic engine start-stop (AESS) typically uses a central computer to monitor vital engine parameters, such as battery charge, water temperature, and brake pressure, and automatically shuts off the engine after a set time. The AESS provides an automatic, fully integrated mechanism to reduce idling and does not rely upon a locomotive operator or require additional engines or infrastructure. This technology is generally applicable to more locomotive types and operating conditions than other ILD devices.

Other ILDs include diesel driven heating systems (DDHS), stationary power plug-in units, and locomotive auxiliary power units (APU). These ILD technologies can reduce locomotive idling time under certain conditions. For example, a DDHS is particularly effective in colder climates, while a stationary power plug-in unit is feasible only for site-specific locomotives where plug-in technology can be permanently located. Costs for these ILDs range from $4,000 to $12,000 for a shore power plug-in unit, $8,000 to $15,000 for an AESS, and $25,000 to $35,000 for an DHSS or APU.

Because an AESS unit can provide significant and predictable air quality benefits at a relatively low cost, all locomotive projects without a functioning ILD must install an AESS, if feasible, to receive program funding. The Carl Moyer Program shall pay actual equipment costs up to a maximum of $8,000 for the AESS and actual installation costs of the AESS up to $3,400. The award cap reflects the fact that AESS installation significantly reduces locomotive operating costs and has a typical capital payback period of one to three years. Other ILD technologies may be considered for program

funding on a case-by-case basis if an AESS device cannot be installed on the project locomotive.

D. Alternative Technology Switch Locomotives

In recent years, several diesel-electric hybrid switch locomotives have been funded through the Carl Moyer Program. Hybrid switch locomotives significantly reduce PM and NOx emissions, idling time, and fuel use compared to conventional switchers. These locomotives use the same basic concept as a gas-electric hybrid automobile -- a battery pack powers the locomotive, while a small diesel engine runs as needed to keep the batteries charged. Hybrid locomotives typically utilize an aging locomotive frame and replace the existing large diesel engine, generator, and analog controls with a small diesel generator, battery pack, and computerized control module. The batteries can provide up to 90 percent of the locomotive horsepower at full load, while the remaining power comes from a 300 to 800 horsepower diesel engine. In addition to driving the locomotive, the added weight of the battery pack provides additional traction to propel the locomotive.

Switch locomotive projects which involve replacing the main engine with multiple heavy-duty truck or off-road engines have also become more commonplace. Multi-engine locomotive projects also typically involve significantly refurbishing an existing locomotive frame with new batteries, electronics, and controls. The replacement engines typically have a much lower horsepower rating and lower emissions than the engine they replace. For the purposes of the Carl Moyer Program, hybrid and multiple engine switchers, as described above, are defined as alternative technology switchers.

Switch locomotive purchase practices are unique. Few new locomotives are manufactured and purchased by the railroads for use in switcher service. Instead, as line-haul locomotives get older and less reliable, they are remanufactured for switching service and moved to a rail yard. In many cases, Class III railroads will purchase older switchers when they are retired by Class I railroads. Because railroads do not typically purchase newly manufactured switcher locomotives, an alternative technology switcher is considered a new locomotive purchase for the purpose of the Carl Moyer Program.

Baseline project emissions and costs for alternative technology switchers also reflect differing Class I and Class III regulatory requirements and purchase practices. Since Class I railroads are required to meet federal locomotive remanufacture emission standards for 1973 and newer locomotives, a new Class I switcher would typically emit at Tier 0 emission rates. Class III railroads -- which are not subject to federal requirements and typically purchase older, in-use locomotives -- typically remanufacture to uncontrolled emission levels. Baseline emissions for hybrid and multiple engine switcher projects at Class I and Class III railroads therefore reflect Tier 0 and uncontrolled emission rates, respectively.

The Carl Moyer Program may fund up to 60 percent and 80 percent of the total cost of an alternative technology switcher for Class I and Class III railroads, respectively.

Project funding caps reflect the differential cost of a typical switcher purchased by Class I and Class III railroads, as described above. Funding caps have also been set in recognition that an alternative technology switcher achieves significant fuel cost savings over its lifetime relative to a traditional switch locomotive.

V. Proposed Project Criteria

These criteria provide the minimum requirements for all Carl Moyer Program locomotive projects. Participating districts retain the authority to impose additional requirements in order to address local concerns.

A. General

- Emission reductions obtained through Carl Moyer Program projects must not be required by or used to comply with any federal, state or local regulation, memorandum of agreement/understanding with a regulatory agency, settlement agreement, mitigation requirement, or other legally binding document. Inclusion in a rail yard or port emission reduction plan, lease agreement, or other voluntarily adopted strategy does not exclude a locomotive project from funding eligibility, if such a project is not otherwise required.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to offset any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging banking and trading program.

- Locomotive operators utilizing an alternative emission control plan (AECP) to comply with California's locomotive low-sulfur diesel fuel requirements shall not be eligible for Carl Moyer Program funds.

- Beginning January 1, 2007, all diesel locomotive projects must use ARB low-sulfur diesel fuel. Emission reductions and costs associated with use of ARB low-sulfur diesel shall not be included in project cost-effectiveness calculations.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- Carl Moyer Program grants can be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including tax credits or deductions, grants, or other public financial assistance.

- The contract term for all locomotive projects must be equivalent to the project life. The project life is defined as the number of years used to evaluate project cost-effectiveness.

- Class I freight locomotive projects must have a minimum project life of ten years. All other locomotive projects have a minimum project life of three years. ARB may approve a shorter project life on a case by case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The maximum project life for a locomotive project is 20 years.

- Because of uncertainty in locomotive load factors, locomotive project activity must be based upon fuel consumption.

- Seventy-five percent of estimated annual miles traveled and annual fuel consumption must occur in California.

- The energy consumption rate for a locomotive engine is 20.8 bhp-hr per gallon. The energy consumption factor for an on- or off-road engine used in a locomotive application is 18.5 bhp-hr per gallon.

- Carl Moyer Program funds cannot be use to pay for labor or parts used during routine maintenance.

- Class I locomotives subject to the South Coast MOU are eligible for Carl Moyer Program funding only if such locomotives are excluded from the fleet average emission rate calculations which demonstrate compliance with the MOU provisions. The baseline emission rates used to determine emission reductions and cost-effectiveness for these locomotive projects reflect the Tier 2 emission rates for line-haul and switch locomotives identified in Table B-16. Locomotives subject to the South Coast MOU which receive Carl Moyer Program funding are ineligible to receive fleet average emission credits.

- Military and industrial locomotives and locomotives owned or operated by Class II railroads use the same Carl Moyer Program criteria as Class III railroad locomotives.

- Locomotive engine emissions must be determined following the most current and approved U.S. EPA emission testing procedures for locomotives.

- All locomotive new purchase or repower projects must include an electronic monitoring unit (EMU) to track activity and geographic location. Eligible EMUs include a geographic positioning system (GPS) unit, transponding device, automated vehicle locator (AVLs), or other similar device. The EMU must be capable of providing complete digital information regarding total activity both within the air district and the State of California; this information shall be reported to air districts

annually for the project life. The full purchase and installation cost of the EMU is eligible for Carl Moyer Program funding, and may be included when calculating project cost-effectiveness. The grantee is responsible for assuring the locomotive is equipped with a working EMU for the full project life.

- An EMU must be used to electronically monitor activity and fuel consumption by fuel type for all liquefied natural gas-diesel or other dual fuel locomotive projects. This information must be provided to the air district annually for the life of the project.

- Potential projects which fall outside of these criteria may be considered on a case-by-case basis if evidence provided by the air district suggests potential surplus, real, quantifiable, and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

B. New Purchase

- Purchase of a new locomotive must achieve federal Tier 2 locomotive emission standards for PM and hydrocarbon emissions, and a NOx emission rate at least 30 percent below Tier 2 locomotive emission standards.

- For the purposes of the Carl Moyer Program, an alternative technology switcher is defined as a hybrid (e.g., Green Goat) or multiple engine switcher in which an existing locomotive chassis is significantly refurbished with a new engine, brakes, electronic controls, and/or other equipment. An alternative technology switcher project is considered a new locomotive purchase and must meet all emission criteria for a new locomotive purchase as described above. Other switch locomotives may be considered for funding as an alternative technology switcher on a case-by-case basis.

- Baseline emissions for an alternative technology switcher project reflect Tier 0 emission rates for Class I locomotives and uncontrolled emission rates for Class III locomotives. The cost of an alternative technology switcher eligible for Carl Moyer Program funding shall not exceed 60 percent of the total cost of the new switcher for Class I railroad switchers, and 80 percent of the total cost of the new switcher for Class III railroad switchers.

- Baseline emissions and costs for a new locomotive purchase project which is not an alternative technology switcher reflect Tier 2 emission rates and the cost of a new Tier 2 locomotive, respectively.

C. Repower

- Locomotive repower projects must achieve at least a 15 percent NOx reduction beyond existing emission levels.

- Baseline emissions for a locomotive engine repower are based upon federal emission requirements for engine remanufacture (see Section III of this chapter) and the corresponding emission rates in Table B-16. Baseline costs for a locomotive engine repower equal the actual remanufacture cost or $50,000, whichever is greater.

- 1973 and later model year Class III locomotives must achieve at least Tier 0 emission levels, if Tier 0 remanufacture kits are available.

- Alternative-fueled engines must be ARB- or U.S. EPA-certified to achieve a reduced emission level in a locomotive application. Alternative-fueled engines not certified to achieve a reduced emission limit in a locomotive application may be eligible for funding on a case by case basis.

D. Retrofit

- A retrofit device must be ARB-verified to reduce emissions from the project engine in order to be eligible for funding. Non-verified technologies may be considered on a case by case basis if: 1) an application for verification of the retrofit or add-on equipment on the proposed engine category is pending, 2) the retrofit or add-on equipment has been verified or certified by ARB or U.S. EPA for use on a similar engine category, or 3) project emission benefit, durability, and applicability have been or shall be demonstrated through in-situ testing.

- Retrofits considered for funding on a case-by-case basis must be clearly demonstrated to achieve the expected emission reductions for the full project life, function properly under the project locomotive engine duty cycle, and to not harm the locomotive engine.

- Remanufacture emission kits must achieve at least a 15 percent NOx reduction and be U.S. EPA certified to achieve at least Tier 0 locomotive emission standards on the project locomotive engine. Emission kits must be demonstrated not to increase in-use emissions of NOx, ROG, or PM emissions. Individual engine parts or other locomotive components are not eligible for funding except as part of a complete U.S. EPA certified engine retrofit kit.

E. Idle-Limiting Device

- All locomotive purchase and repower projects (except alternative technology switchers) must include purchase and installation of an AESS ILD to reduce

unnecessary engine idling if the locomotive is not already equipped with such a device and AESS installation is technically feasible.

- If not already required by a rule, regulation, MOU, or other legal mandate, the purchase and installation cost of an AESS is eligible for Carl Moyer Program funding, subject to the following limitations:

  – The Carl Moyer Program may provide actual equipment costs up to a maximum of $8,000 for a locomotive-specific AESS.
  •
  – The Carl Moyer Program may provide the lower amount of actual installation costs of the AESS, up to a maximum of $3,400.
  •
  – AESS emission reductions are calculated by applying the ILD emission reduction factors in Table B-17 to the reduced engine emissions.
  •
  – All ILDs must comply with applicable durability and warranty requirements.

F. Scrap

- A baseline engine in a repower project must be destroyed by scrapping or drilling a hole in the engine block rendering it inoperable unless prior approval for alternate disposition has been granted by ARB staff. At the discretion of the district, core charges are eligible for funding and, if included, must be part of the cost-effectiveness calculation.

I. Cost-Effectiveness

Emission reduction benefits represent the difference in the emission levels of the existing baseline technology relative to the newer, reduced-emission technology. Baseline and reduced engine emission factors are listed in Table B-16 in Appendix B. These factors represent U.S. EPA emission factors from *U.S. EPA Technical Highlights – Emission Factors for Locomotives* [December 1997], with fuel correction factors applied.

As mentioned earlier, an AESS ILD is required for all locomotive projects if feasible. An Idle-Limiting Device Emission Reduction Factor, identified in Table B-17, is used to account for the air quality benefits of reduced idling.

Hydrocarbon (HC) emissions or emission limits for diesel locomotive technologies must be converted to ROG emissions based upon the following formula:

$$HC = ROG * 0.98$$

A detailed description and examples of how to calculate cost-effectiveness can be found in Appendix D. Locomotive emission reduction calculations will use either the fuel- or hour-based formula as discussed in Appendix C.

II. Minimum Project Application Requirements

The minimum application requirements for locomotive projects are described below. Air districts have full authority to require additional application, reporting, and monitoring requirements.

A. Application

Districts solicit bids for reduced-emission projects for locomotives. The applicant must provide the minimum information listed in Table 8-3. A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

Table 8-3
Minimum Application Requirements for Locomotive Projects

Air District: Applicant Demographics Company Name: Mailing Address: Physical Address: Contact Number: Contact Name/Title: Contact Phone Number: Project Description Project Name: Locomotive Function (Line-haul, Switch, Passenger): Project Location (Street address): Type of Equipment Application: (New purchase, Repower, or Retrofit) <u>FOR LOCOMOTIVE REPOWER OR NEW PURCHASE</u> 1. Existing and new engine make: 2. Existing and new engine model: 3. Locomotive model year: 4. Existing and new engine horsepower: 5. Existing engine serial number: 6. Percent operated in California: 7. Annual fuel consumption: 8. Cost to rebuild existing engine (parts + labor): 9. Cost of new engine: 10. Cost to install new engine: 11. New engine vendor: 12. New engine installed by:	<u>FOR LOCOMOTIVE RETROFITS</u> 1. Engine make, model, model year, and serial number: 2. Locomotive model year: 3. Percent operated in California 4. Annual fuel consumption: 5. Retrofit equipment manufacturer and name: 6. Retrofit or add-on equipment is warrantied by manufacturer (y/n): 7. Retrofit or add-on equipment is verified or certified by ARB or U.S. EPA (y/n): 8. Cost of retrofit or add-on equipment: 9. Cost of installation: <u>FOR IDLE-LIMITING DEVICE</u> 1. Engine make, model, year, and serial number: 2. Locomotive make, model and year: 3. ILD make, model, year, and serial number: 4. Percent operated in California: 5. Annual fuel consumption: 6. Cost of ILD: 7. Cost of installation:

B. Reporting and Monitoring

Air districts must abide by all reporting and monitoring requirements described in Chapter 1 – Program Administration. Monitoring of project progress ensures that the vehicle or engine is operated as stated in the program application. Records must be retained and updated for the duration of the project life and made available at the request of the air district or ARB.

III. References

Association of American Railroads, 2004. Association of American Railroads, 2004, Overview of U.S. Freight Railroads.

Federal Register, April 16, 1998. Federal Register, Part II - Environmental Protection Agency, Emission Standards for Locomotives and Locomotive Engines Final Rule; 40 CFR Parts 85, 89 and 92; April 16, 1998.

U.S. EPA, 2004. U.S. EPA Advanced Notice of Proposed Rulemaking on the Control of Emissions of Air Pollution from New Locomotive Engines and New Marine Compression-Ignition Engines Less Than 30 Liters Per Cylinder; Docket OAR-2003-0190.

Chapter Nine

MARINE VESSELS

This chapter presents program criteria for marine vessel projects, and provides an overview of types of marine vessels, current emission control requirements, and available emission reduction technologies. The chapter also expands eligibility for Carl Moyer Program marine vessel projects to marine vessels with wet exhaust systems, and utilizes a single set of emission factors for propulsion and auxiliary engines, consistent with federal emission standards.

I. Introduction

Marine vessels eligible for Carl Moyer Program funding include harbor craft and oceangoing ships, but exclude recreational vessels such as personal watercraft. Historically, harbor craft have received the vast majority of Carl Moyer Program funding for marine vessels. However, oceangoing vessels remain eligible for funding if they operate in California Coastal Waters enough to generate cost-effective emission reductions and the proposed project meets all applicable Carl Moyer Program criteria. A map of California Coastal Waters can be found in Figure 9-1.

A. Harbor Craft

Harbor craft include tugboats, fishing vessels, work boats, crew boats, ferries, Coast Guard vessels, and some military vessels. These vessels generally stay within California Coastal Waters and often leave and return to the same port. Tugboats generally have the most powerful engines, averaging about 1,300 horsepower. Commercial fishing and work boats, at the other end of the spectrum, average a little over 200 horsepower [ARB, 2003]. Beginning on January 1, 2007, all fuel sold to harbor craft statewide will be required to meet Air Resources Board (ARB or “Board”) low-sulfur diesel fuel standards. This ARB requirement goes into effect on January 1, 2006 in the South Coast Air Basin.

B. Oceangoing Ships

Oceangoing ships usually travel internationally and include container ships, bulk carriers, general cargo ships, tankers, military ships, auto carriers, cruise ships and ocean-going tugboats. Oceangoing ships generally run on one or more 750 or greater horsepower engines. Most oceangoing ships run their main propulsion engines on a mixture of residual and distillate fuel (heavy fuel oil). Diesel gas turbine propulsion engines and auxiliary engines on ocean-going ships often run on cleaner marine gas oil (MGO).

C. Propulsion Engines

Both propulsion and auxiliary marine vessel engines are eligible for Carl Moyer Program funding. For the purpose of the Carl Moyer Program, a propulsion engine is defined as an engine that powers the vessel through the water or directs the movement of the vessel. About two-thirds of harbor craft in California have one propulsion engine, while the remaining vessels have two or more engines [ARB, 2003]. Unlike most recreational vessel engines, harbor craft engines typically push the vessel through the water rather than hydroplaning, endure heavy use, and operate up to 6,000 hours a year. Harbor craft propulsion engines are therefore designed for prolonged operation at high loads.

Ocean-going vessels may be propelled by diesel piston engines, steam turbines, or diesel-fueled gas turbines. In addition, diesel piston or turbine engines on oceangoing vessels may be used to drive generators to create electric power for propulsion.

D. Auxiliary Engines

Auxiliary engines are used to power on-board equipment such as electrical lights, refrigeration units, and radios. For the purposes of the Carl Moyer Program, an auxiliary engine is defined as a marine vessel engine that is not the propulsion engine whose fuel, cooling, or exhaust systems are an integral part of the vessel or require special mounting hardware. All other auxiliary engines are considered portable and may be eligible for funding under the Off-Road Compression Ignition project criteria (See Chapter 5).

About 40 percent of harbor craft in California have auxiliary engines; almost half of these vessels are equipped with more than one engine [ARB, 2003]. Harbor craft auxiliary engines range from 4 to 400 horsepower, with ferries, tug boats, and commercial work boats having the highest horsepower auxiliary engines.

II. Emissions

Marine vessels are a significant source of airborne particulate matter (PM) and oxides of nitrogen (NOx), particularly at and around the State's major maritime ports. The Ports of Los Angeles and Long Beach are among the busiest in the world, and emissions from marine vessels serving the ports are recognized to impact air quality in surrounding communities and the South Coast Air Basin. At the Port of Los Angeles, for example, marine vessels are responsible for about two-thirds of port-related NOx emissions and over 80 percent of port-related PM emissions -- locomotives, heavy-duty trucks, and cargo-handling equipment contribute the bulk of remaining emissions [Port of Los Angeles Air Quality Task Force, 2005]. As trade with the Pacific Rim countries continues to grow, marine vessel emissions are projected to increase significantly.

As shown in Table 9-1, emissions from ocean-going ships are far greater than emissions from harbor craft. The majority of California's commercial marine vessel NOx and PM emissions (excluding emissions in the outer continental shelf) occur in the

South Coast Air Basin. The San Francisco Bay Area, home to the Port of Oakland, is responsible for another 20 percent of the State's total marine vessel emissions.

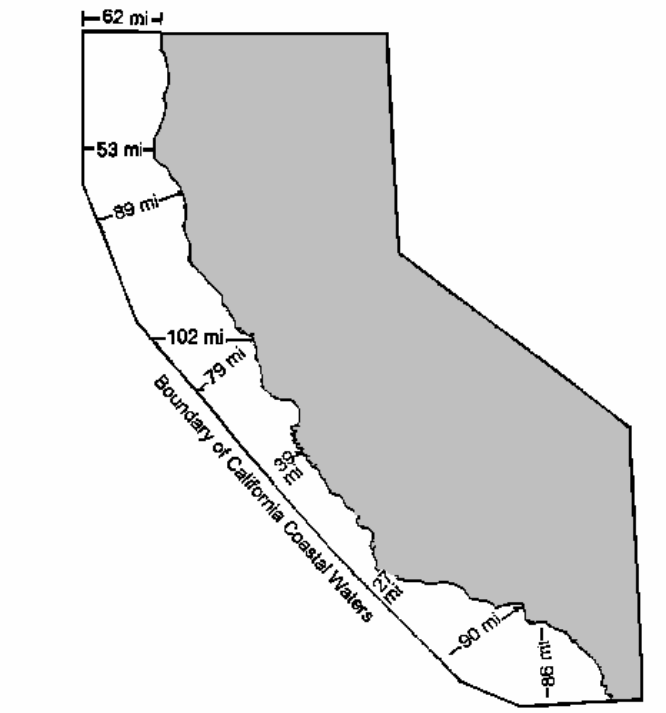
Table 9-1
Marine Vessel Emissions
(Statewide, Annual Average, tpd)

Pollutant by Vessel Type	2005	2010	2015	2020
NOx				
Harbor Craft	24	25	25	25
Ocean-going Ships	119	132	156	181
Total	143	157	181	206
PM				
Harbor Craft	1.3	1.3	1.3	1.4
Ocean-going Ships	10.3	11.3	13.0	14.9
Total	11.6	12.6	14.4	16.2
ROG				
Harbor Craft	3	3	3	3
Ocean-going Ships	6	7	8	10
Total	9	10	11	13

Based on the 2005 ARB Emission Inventory Almanac. Numbers may not total due to rounding.

PM tends to be a localized pollutant, having the greatest impact in proximity to where it is emitted. PM emissions from vessels which spend much of their time further off-shore, such as fishing vessels, may therefore have less of a human health impact than emissions from vessels which operate closer to shore. At this time, however, PM emission standards for marine vessel engines do not differentiate by vessel type based upon the potential for human exposure. ARB staff will evaluate whether PM emissions from certain vessels should be discounted based on exposure potential in future Carl Moyer Program Guideline revisions.

Figure 9-1
California Coastal Water Boundaries



III. Regulatory Requirements

Most marine vessels in operation today have uncontrolled engines, since marine vessel emission standards have only recently begun being phased-in. Harbor craft began being subject to U.S. Environmental Protection Agency (U.S. EPA) emission standards beginning in 2004, while new oceangoing vessels have recently become subject to federal and international emission standards.

A. Harbor Craft Emission Standards

Unlike other Carl Moyer Program categories, marine vessel propulsion and auxiliary engine emission standards are based upon cylinder displacement rather than horsepower. Basing standards on displacement rather than horsepower is intended to help ensure that each engine is not subject to multiple standards, since marine engines can be tuned for different power output.

U.S. EPA harbor craft emission standards, adopted in 1999, apply to new diesel-powered engines with a displacement of up to 30 liters per cylinder. The standards apply to both propulsion and auxiliary engines and take effect between 2004 and 2007, depending upon the engine size [Federal Register, 1999]. Table 9-2 provides more information regarding federal harbor craft engine standards.

Table 9-2
U.S. EPA Marine Propulsion and Auxiliary Engine Emission Standards (g/kW-hr)*

Displacement (liter/cyl)	Starting Date	NOx+THC**	PM
D < 0.9	2005	7.5	0.40
0.9 ≤ D < 1.2	2004	7.2	0.30
1.2 ≤ D < 2.5	2004	7.2	0.20
2.5 ≤ D < 5.0	2007	7.2	0.20
5 ≤ D < 15	2007	5.8	0.20
15 ≤ D < 20 (P < 3300 kW)	2007	7.8	0.27
15 ≤ D < 20 (P ≥ 3300 kW)	2007	8.7	0.50
20 ≤ D < 25	2007	9.8	0.50
25 ≤ D < 30	2007	11.0	0.50

* grams per kilowatt-hour.
** NOx plus total hydrocarbon emissions.

In May 2004, U.S. EPA issued an Advanced Notice of Proposed Rulemaking, signaling its intent to pursue more stringent standards for new and existing harbor craft engines [U.S. EPA, 2004]. The standards are likely to be modeled after 2007 diesel off-road and 2010 heavy-duty diesel on-road engine standards, and be based on the application of catalytic after-treatment technology. The new standards could be phased in as early as 2011 and require a 90 percent reduction from previous limits.

ARB staff is also developing a rule that may require the Best Available Control Technology (BACT), such as after-treatment devices or accelerated turnover, to reduce emissions from existing harbor craft fleets. The rule is scheduled to be considered for adoption by the Board in mid- to late-2006. If the rule is adopted, ARB shall publish an advisory describing how the rule impacts Carl Moyer Program funding eligibility.

B. Oceangoing Vessel Emission Standards

International oceangoing vessels fall under the regulatory jurisdiction of the International Maritime Organization (IMO). In 1997, the IMO established NOx emission standards for diesel-powered propulsion and auxiliary engines over 130 kW (174 hp) on new ocean-going ships. The IMO standards have been ratified by the requisite number of nations and became enforceable in May 2004. Engine manufacturers have generally produced IMO-compliant engines since January 1, 2001, however, since the standards were retroactive to that date upon ratification.

Table 9-3
International Maritime Organization NOx Emission Standards

Engine Speed (rpm)	NOx (g/kW-hr)	NOx (g/bhr-hr)
n < 130	17.0	12.7
130 ≤ n < 2000	$45n^{(-0.2)}$	(convert from g/kW-hr)
n ≥ 2000	9.8	7.3

n = IMO rated engine speed (crankshaft revolutions per minute).

U.S. EPA also adopted NOx emission standards for new oceangoing vessel engines in 2003 [U.S. EPA, 2003]. The federal standards are virtually equivalent to the IMO standards but apply only to vessels flagged or registered in the United States beginning in 2004. U.S. EPA has also committed to adopt more stringent standards for oceangoing vessel engines by April 2007. The IMO and U.S. EPA standards do not include PM or reactive organic gas (ROG) emission limits, leaving marine vessels largely unregulated for these pollutants.

An ARB rule requiring oceangoing vessel auxiliary engines run on MGO or marine diesel oil (MDO) while at dock or in California Coastal Waters is also under development. Use of MGO or MDO in place of dirtier heavy fuel oil can achieve up to 80 percent emission reductions from oceangoing vessel auxiliary engines. The draft rule is scheduled to be considered by the Board in December 2005 and could require implementation beginning in mid-2006.

Finally, ARB staff is developing a rule to require ships that visit California frequently to implement emission reduction strategies. The rule will be considered for adoption by the Board sometime in 2006. ARB will publish an advisory once these rules are adopted describing how each rule impacts Carl Moyer Program funding eligibility.

C. Voluntary Emission Standards—The Blue Sky Series Program

In order to provide engine manufacturers with an incentive to produce engines that are cleaner than those required by regulations, the federal government developed the Blue Sky Series Program. U.S. EPA's voluntary Blue Sky Series Program permits manufacturers to certify their engines to more stringent emission standards than required. New marine vessel purchase projects must meet the federal Blue Sky Standards to qualify for Carl Moyer Program funding. To date, no marine vessel propulsion engines have been certified to meet the Blue Sky standards, and no marine vessel new purchase projects have been funded through the Carl Moyer Program.

Table 9-4
"Blue Sky Series" Voluntary Emission Standards
(g/kW-hr)

Cylinder Displacement (D, dm^3)	NOx+THC	PM
Power ≥ 37 kW & D < 0.9	4.0	0.24
0.9 ≤ D < 1.2	4.0	0.18
1.2 ≤ D < 2.5	4.0	0.12
2.5 ≤ D < 5.0	5.0	0.12
5.0 ≤ D <15	5.0	0.16
15 ≤ D < 20 & Power < 3300 kW	5.2	0.30
15 ≤ D < 20 & Power < 3300 kW	5.9	0.30
20 ≤ D < 25	5.9	0.30
25 ≤ D < 30	6.6	0.30

IV. Potential Projects

The vast majority of Carl Moyer Program marine vessel projects thus far involve harbor craft, rather than oceangoing vessels. Harbor craft projects have been more common due to several factors – their emissions tend to occur solely within California Coastal Waters, vessel activity is more predictable, and engine replacement is extremely cost-effective.

Marine vessel projects that could potentially qualify for incentive funding under the Carl Moyer Program for marine vessels include the purchase of a new reduced emission marine vessel, a marine vessel repower, or a marine vessel retrofit. Shore power projects to reduce marine vessel auxiliary engine emissions may also be eligible for Carl Moyer Program funding and are discussed in Chapter 12. Projects to replace gasoline-fueled engines with diesel engines are not eligible for funding.

A. New Purchase

New marine vessels with propulsion engines certified to U.S. EPA's Blue Sky Series emission limits are eligible for Carl Moyer Program funding. While no marine vessel propulsion engines currently meet the Blue Sky Standards, engines meeting certification emission limits may become commercially available as engine technologies continue to advance.

B. Repower

To date, most Carl Moyer Program marine vessel projects have involved replacing or "repowering" an old harbor craft engine with a newer, cleaner engine. Most of these projects have involved replacing an older mechanical engine with a newer electronically controlled engine. For all Carl Moyer Program engine repowers, the replacement engine certified emission rate must provide at least a 15 percent NOx reduction relative to the baseline engine. If the replacement engine is significantly modified or re-

configured in any way during the project life, emissions testing must be conducted to determine its new emission rates.

Engine repowers for marine vessels equipped with wet exhaust system are eligible for Carl Moyer Program funding. Since a wet exhaust system reduces air emissions from both the baseline and the newer, cleaner engine, repower projects on marine vessels with these systems may result in slightly fewer emission reductions compared to repowers of vessels with dry exhaust. An analysis of emissions data from California harbor craft indicates wet exhaust systems reduce PM and NOx emissions from propulsion and auxiliary engines by 1 to 19 percent. In order to ensure emission reductions projects on vessels with wet exhaust systems are not overstated, a conservative 20 percent NOx and PM emission reduction factor must be applied to both the baseline and reduced emission engine (See marine vessel example calculation 3 in Appendix D for more information). The Carl Moyer Program does not provide funding to repair or replace any component of the wet exhaust system itself.

C. Retrofits

Potential marine vessel retrofit projects involve the addition of an ARB-verified diesel particulate filter, diesel oxidation catalyst, or selective catalytic reduction technology. A retrofit device must typically be verified by ARB in order to be considered for funding. To date, however, very few retrofit technologies have been verified to reduce emissions from marine vessels. Retrofit technologies generally develop first for on-road sources, and are refined for use on off-road engines. Because of the lack of retrofit devices verified for use on a marine vessel engine, a marine vessel retrofit device which is not yet verified may be considered for funding on a case-by-case basis. Applicants for funding on a case-by-case basis must meet the applicable project criteria described in Section V of this chapter.

In recent years, engine manufacturers have also developed engine remanufacture retrofit kits certified by the IMO to meet IMO NOx emission standards. To be eligible for Carl Moyer Program funding, a remanufacture retrofit kit must be certified by the ARB, U.S. EPA, or the IMO to reduce emissions from the project vessel engine. NOx emissions must be reduced by at least 15 percent to take credit for NOx emission reductions. Remanufacture kits which employ fuel injection timing retard are only eligible for funding if it is demonstrated that PM emissions from the project vessel shall not increase. If the retrofit kit certification does not specify a specific percent reduction or emission rate for NOx, PM, or ROG, emissions testing must be conducted annually for the life of the project to ensure the retrofit does not increase emissions from these individual pollutants. Individual engine parts or other vessel components are not eligible for funding unless as part of a complete certified engine remanufacture retrofit kit.

D. On-Board Testing

Because of the high variability in marine engine emission rates, districts may utilize on-board testing to determine baseline marine vessel emission rates for the purposes of

Carl Moyer Program cost-effectiveness calculations, if testing follows approved test procedures. Constant speed propulsion engines should be tested on the International Organization for Standardization's (ISO) 8178- E2 test cycle and constant speed auxiliary engines on the ISO 8178-D2 test cycle. Variable speed auxiliary engines and variable speed propulsion engines used with variable-pitch propellers (or electrically coupled propellers) should be tested on the ISO 8178-C1 duty cycle. All other engines, including those used with fixed-pitch propellers, should be tested on the ISO 8178-E3 Marine Propeller Law Heavy Duty operating cycle. When on-board testing is conducted in accordance with approved procedures, these results must be used when calculating emission reductions. The maximum acceptable values of baseline NOx, ROG, and PM emission factors derived from in-situ source testing are 20 g/bhp-hr, 2.0 g/bhp-hr, and 1.0 g/bhp-hr, respectively. If emission testing is not feasible, the applicant can use the default baseline emission factors presented in Appendix B.

V. Proposed Project Criteria

These criteria provide the minimum requirements for all Carl Moyer Program marine vessel projects. Participating districts retain the authority to impose additional requirements in order to address local concerns.

A. General

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding with air quality regulators, settlement agreement, mitigation requirement, or other legal mandate. Inclusion in a port emission reduction plan, lease agreement, or other voluntarily adopted strategy does not exclude a marine vessel project from Carl Moyer Program funding eligibility, if such project is not otherwise required.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to offset any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging banking and trading program.

- Marine vessels and engines utilizing an alternative compliance plan to comply with a rule, requirement, or other mandate shall not be eligible for Carl Moyer Program funds.

- A marine vessel receiving any type of emission reduction credit or offset is ineligible for Carl Moyer Program funding.

- Beginning January 1, 2007, all harbor craft with diesel engines must use ARB low-sulfur diesel fuel to be eligible for Carl Moyer Program funding. Emission

reductions and costs associated with use of ARB diesel shall not be included in project cost-effectiveness calculations.

- Only marine vessel engines with a United States Coast Guard Documentation Number are eligible for Carl Moyer Program funding. This information must be included in the project application.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- Carl Moyer Program grants can be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including tax credits or deductions, grants, or other public financial assistance.

- The contract term for all marine vessel projects must be equivalent to the project life. The project life is defined as the number of years used to evaluate project cost-effectiveness.

- Projects must have a minimum project life of three years. ARB may approve shorter project life on a case by case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The maximum project life for marine vessel projects (equivalent to the average engine life reported by U.S. EPA) is as follows:

	Maximum Project Life
Engine displacement ≤5.0 liter/cyl.	16 years
Engine displacement >5.0 liter/cyl.	23 years
Auxiliary engines	17 years

- Only marine vessel activity in California waters may be used to determine project emission reductions. For the purposes of the Carl Moyer Program, California water boundaries are based upon each air districts' emission inventory boundary. If a local district has not established an emission inventory boundary, the ARB and district staff will determine an appropriate boundary for use in project evaluation.

- Non-captive California fleets and vessels may be considered for funding on case-by-case basis if their operation in California coastal waters can be properly documented.

- Marine vessels which are not self-propelled (e.g. barges) are not eligible for Carl Moyer Program funding.

- Project marine vessels must be equipped with a functioning tamper proof electronic monitoring unit (EMU) to track activity and geographic location. The EMU must be turned on and functional when the project engine is running for the life of the project, to record all vessel trips and activity. If the EMU is battery powered, the battery life must be long enough to ensure the EMU is charged and functional each time the project vessel is operated. Electronic information from the EMU regarding total and percent of activity (fuel use or hours of operation) within the air district coastal boundary and California Coastal Waters must be reported to air district annually for the project life. The cost of a new unit may be included in the Carl Moyer Program grant and in the project cost-effectiveness calculations if not required by any rule, statute, MOU, or other mandate. The grantee is responsible for assuring a working EMU is on the project vessel for the full project life.

- Carl Moyer Program funds cannot be expended on costs for labor or parts used during routine maintenance.

- Funding is not available for projects where spark-ignition engines (i.e. natural gas or gasoline, etc.) are replaced with new diesel engines.

- Engines on marine vessels with wet exhaust systems are eligible for Carl Moyer Program funding if the project vessel meets all other applicable program requirements. The wet exhaust systems themselves are not eligible for Carl Moyer Program funding. A wet exhaust factor of 0.80 must be applied to the baseline and reduced emission propulsion and auxiliary engine emission calculations for all projects on vessels with wet exhaust systems.

- Potential projects which fall outside of these criteria may be considered on a case by-case basis if evidence provided by the air district suggests potential surplus, real, quantifiable, and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on a case-by-case basis. All projects considered for funding on a case-by-case basis must receive ARB approval prior to receiving program funding.

B. New Purchase

- A new marine vessel must meet the U.S. EPA Blue Sky Series Standards identified in Table 9-4 to be eligible for funding. All propulsion and auxiliary engines on new marine vessel purchase projects must also achieve at least a 30 percent NOx emission reduction from baseline levels.
-

C. Repower

- A replacement engine or retrofit must provide a 15 percent minimum NOx emission reduction relative to the baseline engine.

D. Retrofit

- A retrofit device must be ARB-verified to reduce emissions from the project engine in order to be eligible for funding. Non-verified technologies may be considered on a case by case basis if: 1) an application for verification of the retrofit or add-on equipment on the proposed engine category is pending, 2) the retrofit or add-on equipment has been verified or certified by ARB for use on a similar engine category, or 3) project emission benefit, durability, and applicability have been or shall be demonstrated through in-situ testing.

- Retrofits considered for funding on a case-by-case basis must be clearly demonstrated to achieve the expected emission reductions for the full project life, function properly under the project vessel engine duty cycle, and to not harm the vessel engine.

- To be eligible for Carl Moyer Program funding, a retrofit emission kit must be certified by the ARB, U.S. EPA, or the IMO to reduce emissions from the project vessel engine. NOx emissions must be reduced by at least 15 percent to take credit for NOx emission reductions. Engine retrofit kits must also not increase NOx, PM, or ROG emissions from the project vessel. If the engine certification does not specify a specific percent reduction or emission rate for NOx, PM, or ROG, emissions testing must be conducted annually for the life of the project to ensure the retrofit does not increase emissions from these individual pollutants. Individual engine parts or other vessel components are not eligible for funding unless as part of a complete certified engine retrofit kit.

E. Scrap

- A baseline engine in a repower project must be destroyed by scrapping or drilling a hole in the engine block rendering it inoperable unless prior approval for alternate disposition has been granted by ARB staff. At the discretion of the district, core charges are eligible for funding and, if including, must be part of the cost-effectiveness calculation.

VI Cost-Effectiveness Calculations

Emission reduction benefits represent the difference in the emission levels of the existing baseline technology relative to the newer, reduced-emission technology. Baseline and reduced engine emission factors are listed in Table B-18 in Appendix B. Harbor craft emission factors represent off-road engine emission factors for uncontrolled

engines, and harbor craft emission standards for controlled engines. Fuel correction factors have been applied to all emission factors.

A detailed description of how to calculate cost-effectiveness can be found in Appendix B. Marine vessel emission reduction calculations will use either the fuel- or hour-based formula as discussed in Appendix B. Examples of cost-effectiveness calculations can also be found in Appendix B.

VII. Minimum Project Application Requirements

These are minimum project application requirements. Air districts have full authority to require additional application, reporting, and monitoring requirements.

A. Application

Districts solicit bids for reduced-emission projects for marine vessels. The applicant must provide the minimum information illustrated in Table 9-5.

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

Table 9-5
Minimum Application Requirements for Marine Vessel Projects

Air District: Applicant Demographics • Company Name: • Mailing Address: • Physical Address: • Contact Number: • Contact Name/Title: • Contact Phone Number: Project Description • Vessel Name: • Vessel U.S. Coast Guard Doc. No. (or IMO/Lloyd's No., if foreign flagged): • Vessel function (Fishing vessel, tugboat, work boat, etc…): • Vessel berth location: • Does vessel remain with the port only (y/n): • Propulsion or auxiliary engine project: • Hours project engine operates or project engine fuel consumption within California Coastal Waters: Type of Equipment Application: (Repower or Retrofit) <u>FOR MARINE VESSEL REPOWERS</u> 1. Existing and new engine make: 2. Existing and new engine model: 3. Vessel model year:	<u>FOR MARINE VESSEL REPOWERS (Cont.)</u> 4. Existing and new engine horsepower: 5. New engine cylinder displacement 6. Existing engine serial number: 7. Cost to rebuild existing engine (parts + labor): 8. Cost of new engine: 9. Cost to install new engine: 10. New engine vendor: 11. New engine installer: <u>FOR MARINE VESSEL RETROFITS</u> 1. Engine make, model, model year, and serial number: 2. Vessel model year: 3. Retrofit equipment manufacturer and name: 4. Retrofit or add-on equipment is warrantied by manufacturer (y/n): 5. Retrofit or add-on equipment is verified or certified by ARB or U.S. EPA (y/n): 6. Cost of retrofit or add-on equipment: 7. Cost of installation:

B. Reporting and Monitoring

Air districts must abide by all reporting and monitoring requirements described in Chapter 1 – Program Administration. Monitoring of project progress ensures that the vessel or engine is operated as stated in the program application. Records must be retained and updated for the duration of the project life and made available at the request of the air district or ARB.

VIII. References

ARB, 2003. California Air Resources Board 2003 Harbor Craft Survey.

Federal Register, 1999. *Federal Register - Environmental Protection Agency, Control of Emissions of Air Pollution From New Marine Compression-Ignition Engines at or Above 37 kW*, December 29, 1999 (Volume 64, Number 249).

Port of Los Angeles Air Quality Task Force, 2005. Port of Los Angeles Air Quality Task Force, *Port of Los Angeles No Net Increase in Air Emissions Final Report*, June 24, 2005.

U.S. EPA, 2003. U.S. EPA, Control of Emissions From New Marine Compression-Ignition Engines at or Above 30 Liters Per Cylinder, Federal Register 9745-9789, 28 Feb 2003.

U.S. EPA, 2004. United States Environmental Protection Agency, *U.S. EPA Advanced Notice of Proposed Rulemaking on the Control of Emissions of Air Pollution from New Locomotive Engines and New Marine Compression-Ignition Engines Less Than 30 Liters Per Cylinder* (Docket OAR-2003-0190).

Chapter Ten

AGRICULTURAL SOURCES

This chapter presents the project criteria under the Carl Moyer Program for stationary and portable agricultural engines and for non-engine agricultural projects (e.g. dairies). Previous versions of the Carl Moyer Program Guidelines only allowed funding for stationary agricultural irrigation pump engines; eligible projects now include other non-mobile agricultural engines and non-engine sources. Information about mobile agricultural use equipment (e.g. tractors) can be found in Chapter 5: Compression Ignition Off-Road Equipment. This chapter also contains an overview of agricultural sources of air pollution, current regulations, potential project types, and application requirements. For information about electric-powered agricultural equipment, please consult Chapter 12: Zero-Emission Technologies.

I. Introduction

The agricultural industry contributes greatly to the economy and identity of California. Approximately 78,500 farming operations within California produce 13 percent of the nation's gross farming receipts, while representing only four percent of the total farms in the nation. Agricultural marketings from California's farmers and ranchers reached $27.8 billion in 2003 [CASS, 2003].

Until the enactment of Senate Bill 700 (SB 700, Florez) in 2003, the agricultural industry in California was largely exempt from air pollution regulations. Local air districts are currently adopting regulations to reduce air pollution from agricultural engines as well as other agricultural sources.

Since 1998, the Carl Moyer Program has provided significant funding for repowers or retrofits of internal combustion engines powering irrigation pumps, and for engine replacement of self-propelled farm equipment. Recent legislative changes extended the Carl Moyer Program to additional agricultural sources of air pollution.

II. Emissions

Emissions attributed to agricultural use off-road vehicles are included in the emissions estimates found in the Chapter 5: Compression Ignition Off-Road Equipment. Currently available estimates for other agricultural sources are discussed below.

As part of the airborne toxic control measure (ATCM) for stationary diesel engines, ARB staff worked with the local districts and the agricultural community to create an estimate of emissions from stationary diesel-fueled engines used in agricultural operations [ARB, 2003]. ARB staff was unable to project the emissions for future years with any degree of certainty because of the limited data available. The emissions estimates for stationary agricultural use diesel engines are shown in Table 10-1.

Table 10-1
Statewide Emissions from Agricultural Use Stationary Diesel Engines for 2001
(prime engines, tons per day)

Population	NOx	ROG	PM10
5,338	21.1	4.3	1.5

No emissions estimates for stationary spark-ignited (SI) agricultural use engines are available because the population of stationary SI engines in agricultural operations is not known.

Emission estimates for livestock operations were developed for the recent regulatory process for creating a definition for large confined animal facility (CAF) [ARB, 2005]. The emission estimates (found in Table 10-2) are based on current best available data as of March 2005. The emission factors used to develop livestock emission estimates will be refined as additional research studies are completed.

Table 10-2
Statewide ROG and PM10 Emissions from Livestock for 2004
(tons per day)

	ROG	PM10
Dairies	35.7	8.3
Other livestock	10.1	11

III. Statutory and Regulatory Requirements

A. SB 700

In 2003, SB 700 amended and added air pollution control requirements in the California Health and Safety Code (sections 39011.5, 39023.3, 40724, 40724.5, 40724.6, 40724.7, 40731, 42301.16, 42301.17, 42301.18, 42310, and 44559.9) to include requirements for agricultural sources of air pollution. Some of the key requirements of this legislation are listed below:

- The legislation defined "agricultural source of air pollution" as a source or group of sources used in the production of crops or raising of fowl or animals located on contiguous property and under common ownership or control. Four categories of emission sources are identified as part of this definition:
  - Large CAFs.
  - Internal combustion engines, including portable and off-road engines, unless used to propel instruments of husbandry.
  - Sources subject to requirements of Title V, the federal operating permitting program for major stationary sources.
  - Sources of emissions otherwise subject to district regulation.

- The legislation removed language exempting agricultural sources from air quality permits in the Health and Safety Code in its entirety. As a result, agricultural operations may be required to obtain air permits from local districts.

- The legislation established specific agricultural source permitting and exemption requirements for local districts.

- The legislation required certain districts to adopt by regulation a set of measures to reduce emissions from agricultural sources in federal particulate matter non-attainment areas.

- The legislation required the ARB to establish a definition for a "large" CAF, and required certain districts to adopt rules requiring large CAFs to obtain permits and implement emission mitigation measures.

B. Stationary Diesel Engine ATCM

In February 2004, the Board adopted an ATCM for stationary compression ignition (CI) engines greater than 50 horsepower. The Board amended the ATCM in May 2005. The control measure requires new CI engines for agricultural operations, including those used to repower agricultural equipment, to meet ARB and federal new off-road engine PM certification standards for engines of the same horsepower and model year. The only exception to this requirement is for the installation of Tier 2 engines through January 1, 2008 purchased with Carl Moyer Program funds.

ARB staff is currently working on the development of in-use stationary diesel agricultural engine requirements to be considered by the Board in early 2006.

C. Large Confined Animal Facility Definition

In response to the requirements of SB 700, the Board approved a definition for large CAF on June 23, 2005. The definition (shown in Table 10-3) is based on headcount of livestock categories and takes into consideration the federal ozone attainment status of districts as well as livestock population and operational practices of facilities. A recordkeeping component requires the owner or operator of a large CAF to keep a daily record of animals at the facility and to submit the information to the local air district consistent with applicable local rules.

Table 10-3
Large Confined Animal Facility Definition by Livestock Category
(facilities at or exceeding threshold are considered large)

Livestock Category	Non-Attainment Areas*	Attainment Areas*
Dairy	1,000 milk producing cows	2,000 milk producing cows
Beef feedlots	2,500 beef cattle	5,000 beef cattle
Other Cattle Operations	7,500 calves, heifers, or other cattle	15,000 calves, heifers, or other cattle
Chickens – Broilers	650,000	1,300,000
Chickens – Egg Layers	650,000	1,300,000
Turkeys	100,000	200,000
Swine	3,000	6,000
Sheep and Goats	15,000	30,000
Horses	2,500	5,000
Ducks	650,000	1,300,000
Rabbits, Pheasants, Llamas, Others	30,000	60,000

*Federal 1-hour ozone designation as of January 1, 2004

By July 1, 2006, air districts in federal ozone non-attainment areas must adopt rules requiring large CAFs to submit a mitigation plan to reduce air contaminants to the extent feasible. Each air district in a federal ozone attainment area must adopt a similar rule by July 1, 2006, unless its district board makes a finding in a public hearing that large CAFs will not contribute to violations of state or federal standards. Large CAFs have six months from the date of adoption of the district rule to submit their mitigation plans to the district; the districts have an additional six months to approve submitted plans. One year after submitting their plans (July 1, 2008), large CAFs must comply with the requirements of their mitigation plans.

D. Local Air District Rules

Because most Carl Moyer Program projects affect mobile sources that are subject to statewide regulation, few district rules affect Carl Moyer Program funding. However, future district rules impacting agricultural sources must be considered when determining whether projects provide reductions surplus to regulatory requirements.

Internal combustion engines: Prior to the adoption of SB 700, most air districts specifically exempted agricultural engines from prohibitory rules for stationary IC engines greater than 50 horsepower. As a result, stationary agricultural engine emissions were largely uncontrolled. These districts have amended (or will amend) their internal combustion engine rules to remove the agricultural operation exemption. In these districts, stationary internal combustion engines used in agricultural operations are now required (or will be required) to meet the emission standards/limits, permitting conditions, and compliance requirements of the local district.

Large Confined Animal Facilities: As outlined in the previous section, local air districts in federal ozone non-attainment areas are required to adopt rules developed to mitigate emissions from large CAFs. Local air districts in federal ozone attainment areas are also required to develop rules to mitigate large CAF emissions unless their district boards make a finding in a public hearing that large CAFs will not contribute to violations of state or federal standards. A number of air districts have or are preparing to adopt regulations to meet these requirements.

Fugitive Dust Control: A number of air districts require agricultural operations to reduce fugitive dust emissions through local rules. Local rules for particulate matter dust control generally require agricultural operations to implement a variety of practice-specific options to reduce particulate matter. These practices may include methods to reduce the movement of soil during land preparation, cultivation, and harvesting, suppression of dust on unpaved roads, alternatives to burning, and reduction of agricultural chemical applications.

IV. Potential Projects

Potential Carl Moyer Program projects for agricultural sources fall into three broad categories:

- Mobile source projects. Criteria for the projects may be found in Chapter 5: Compression Ignition Off-Road Equipment.
- Stationary and portable agricultural engines.
- Non-engine agricultural sources.

The Carl Moyer Program seeks cost-effective emission reductions from stationary and portable agricultural engines operating in California. Criteria are designed to ensure that the emission reductions expected through the deployment of electric motors, reduced-emission engines, or retrofit technologies under this program are real, surplus, enforceable, and quantifiable. In addition, at each district's discretion, eligible projects may be subject to funding or cost-effectiveness caps.

A. New Purchase

ARB staff is proposing that the only Carl Moyer Program eligible project for a new agricultural stationary or portable equipment purchase is a new electric motor. For the purposes of determining emission reductions, the new electric motor will be compared to an off-road diesel engine certified to the current off-road emission standards.

B. Repower

1. Repower with Electric Motors

Replacement of uncontrolled or older engines in agricultural operations with electric motors provides significant emission benefits. Diesel and SI engines may be repowered with electric motors. In addition, selected costs for necessary peripheral equipment associated with the motor (e.g., control panel, motor leads, service pole with guy wire, connecting electric line) may be included in determining the grant amount awarded.

In June 2005, the Public Utilities Commission approved a reduced electricity rate and line extension allowance for Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) to be used for conversion of stationary agricultural IC engines to electric. Individuals enrolling in the PG&E and SCE incentive programs may receive funds through the Carl Moyer Program for an electric motor replacing an internal combustion engine, regardless of whether they are currently under Carl Moyer Program contract. Because of the limited enrollment timeframe, ARB will allow grantees currently under contract to negotiate new contracts if they choose to participate in the utilities' incentive programs. Please refer to Chapter 12: Zero-Emission Technologies for specific information on these projects.

2. Repower with Emission-Certified Engines

Stationary and portable agricultural engines may be repowered with new off-road engines certified to the current applicable off-road emission standards. This provision applies to repowers with diesel and SI engines. Diesel engines may be replaced with cleaner diesel or SI engines. SI engines may only be replaced with cleaner SI engines; projects replacing SI engines with diesel engines are not eligible for Carl Moyer Program funding. Emission reductions must be surplus to district rules and any permit conditions. Cost-effectiveness calculations will be based on the rebuild cost of the engine being replaced.

3. Repower with SI Engines Exceeding Local District Requirements

Very few SI engines used in stationary and portable applications have been certified to meet applicable emission standards. Because under certain conditions SI engines can be significantly cleaner than diesel engines, Carl Moyer Program funds may be used to fund purchases of non-certified SI engines in some cases. This provision is available until January 1, 2008. This provides two years for engine manufacturers to certify SI engines for agricultural use. The emission reductions provided by a non-certified SI engine must be surplus to any local district rules. Emission reduction calculations will be based on the rebuild cost of the engine being replaced.

Non-certified SI engines purchased through the Carl Moyer Program will be required to have best available emission control components, and will be subject to source testing

and monitoring requirements as described in the Project Criteria or local district requirements, whichever is more stringent. The costs associated for testing and monitoring may not be included in the grant award.

C. Retrofit

A retrofit involves modifications to the engine and/or fuel system such that the retrofitted engine does not have the same specifications as the original engine. Retrofit projects that reduce NOx may be applicable to certain diesel or SI engine families. Emission control technologies that have been verified for use to reduce NOx and PM10 emissions in other applications for on-road or off-road diesel or SI engines may be applicable to stationary and portable agricultural engines. A NOx retrofit for an uncontrolled diesel engine must be verified to reduce emissions to the applicable new engine tier standard or less for a given engine size and not increase particulate matter. An emission-certified stationary or portable engine may use a retrofit kit that is verified to reduce NOx or NOx + non-methane hydrocarbon (NMHC) emissions by at least 15 percent from the applicable emission standard. Uncontrolled SI engines may use a retrofit kit verified to reduce emissions to the currently applicable standard for large SI equipment, or if not feasible, with a retrofit kit verified to reduce emissions to at least 3.0 g/bhp-hr. The emission reductions provided by a retrofit kit must be surplus to the local district rule. Emission reduction calculations will be based on the emission rates of the existing engine being retrofitted.

Additional information on retrofit emission control strategies is provided in Appendix F.

D. Non-Engine Projects

Recent legislative changes have extended the Carl Moyer Program to non-engine agricultural sources of air pollution. ARB staff propose that the Board direct the Executive Officer to develop and approve project criteria for non-engine agricultural sources where technology is available to ensure the emission reductions are real, surplus, quantifiable, and enforceable. However, no specific project criteria are proposed at this time due to the limited data available on specific control technologies. ARB staff will continue to work closely with the districts and interested stakeholders to monitor technological developments to determine when and if it is it appropriate to develop project criteria for non-engine sources.

Potential control technologies and regulatory options will be evaluated for suitability under Carl Moyer Program requirements. During these evaluations, ARB staff will consider:

- Whether the technology provides real, quantifiable and enforceable emission reductions.
- The availability of standardized testing procedures that will quantify emission reductions from these technologies.

- Availability of baseline emission factors.
- Potential multi-media issues.

While engines have a statewide certification or verification process to prove the emission levels are achieved in practice, there is no comparable statewide process for stationary and area-wide sources. In developing statewide project criteria for non-engine technology, ARB staff will need to consider how to assure that emission reductions are achieved.

If non-engine agricultural projects include reductions of non-combustion PM, the criteria will include a weighting factor for non-combustion PM for use in the cost-effectiveness formula.

The following sections provide background on some potential non-engine agricultural projects.

1. Livestock Operations

Air emissions of concern from livestock include ammonia, nitrous oxide, methane, carbon dioxide, volatile organic compounds (VOC), hydrogen sulfide, and particulate matter. The emissions can come from animal housing, storage areas for manure and wastewater, cropland where manure is applied, and directly from the cows. Livestock emissions are most significant in the San Joaquin Valley and the South Coast Air Basin.

The South Coast Air Quality Management District has adopted Rule 1127 - Emission Reductions from Livestock Waste in 2004. This rule requires dairies to clear manure from corrals more frequently and send the manure to an emissions-controlled compost facility, an anaerobic digester or to agricultural land where manure is approved for spreading as fertilizer.

The San Joaquin Valley Unified Air Pollution Control District recently approved a VOC emission factor to be used for permitting San Joaquin Valley dairies. The District reviewed important classes of VOC constituents and key dairy processes individually before approving a total dairy emission factor of 19.3 lbs/year/head. The District will consider regulations to reduce emissions from dairies in the near future.

With the upcoming SB 700 deadlines for approving large CAF mitigation plans, there is a need for a rapid, objective assessment of which technologies are most likely to be successful in California's unique economic, regulatory, and environmental conditions. The Dairy Manure Technology Feasibility Assessment Panel, created and hosted by the ARB, was convened in February 2005 to carry out this work. Members were drawn from government, industry, academia, and environmental and conservation groups.

The Panel evaluated technologies for their potential to reduce environmental impacts resulting from air emissions and from releases of nutrients, salts, and pathogens to the

environment. The Panel is assessing the ability of the technology to prevent releases of contaminants and is considering their efficacy in reducing environmental impacts, energy production (if any), economic performance (including saleable products produced by the technology), quality of supporting data, and the development status. The Panel's draft report is scheduled for release in mid-October 2005.

In general, potential technologies may be classified into categories including:

- Thermal conversion (including combustion and gasification).
- Solid-liquid separation (including dehydration).
- Composting.
- Anaerobic digestion.
- Aerators/mixers.
- Nitrification/denitrification.
- Covers.
- Microbials, enzymes, and other additives.
- Feed management.
- Trapping nutrients in biomass (crops, plants in constructed wetlands, algae, fish, etc.).
- Combination systems (such as wastewater treatment plants).

It is likely that no single technology will solve all of the problems associated with dairy manure and each dairy will likely require its own unique combination of technologies to address the specific problems of that area. Research stsill needs to be done on VOC emissions to quantify amounts emitted from each portion of the dairy, and reactivity of the chemical species to form ozone. Without this information and a lack of standard testing procedures, it is difficult to assess how various technologies will reduce these emissions, reduce ozone formation, and improve air quality.

2. Other Projects

Non-combustion particulate matter reductions can be achieved through the use of chemical dust suppressants, road paving, and harvesting equipment with catch-frame technology to eliminate the need for sweeping. For some of these projects, multimedia impacts must also be considered.

Another potential project is the evaluation of irrigation pump efficiency. Improvement in pump efficiency through parts replacement and repair has the potential for emission reductions of NOx, ROG and PM by reduced work by the engine or motor for water output.

V. Proposed Project Criteria

The project criteria below have been designed to provide districts and potential applicants with a list of minimum eligibility requirements for Carl Moyer Program funding. Criteria focus on emission reductions, cost-effectiveness, and the ability for a project to be completed within the timeframe of the program. Additional information

about funding electric motors for irrigation pumps is available in Chapter 12: Zero-Emission Technologies.

Participating districts retain the authority to impose additional requirements in order to address local concerns.

A. General

- Projects that replace non-mobile agricultural engines with electric motors should be encouraged. After electric motors, priority should be given to engine repowers with certified engines, and then to engine retrofits and non-certified engines, if applicable.

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state or local regulation, memorandum of agreement/understanding with a regulatory agency, settlement agreement, mitigation requirement, or other legal mandate.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits, or to offset any emission reduction obligation of any person or entity.

- No project funded by the Carl Moyer Program shall be used for credit under any federal or state emission averaging banking and trading program.

- Carl Moyer Program grants can be no greater than a project's incremental cost. The incremental cost is the cost of the project minus the baseline cost. The incremental cost shall be reduced by the value of any current financial incentive that reduces the project price, including tax credits or deductions, grants, or other public financial assistance.

- Projects must have a minimum project life of three years. ARB may approve shorter project life on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap.

- The contract term must extend to the end of the project life.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the air district suggests potential surplus, real, quantifiable, and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on a case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

- An engine must be rated at greater than 25 hp, which is equivalent to an electric motor greater than 19 kW.

- Projects must operate at least 75 percent of total equipment hours in California.

- The default project life when determining project benefits for new purchases or repowers shall be ten years for electric motors. The default project life for engines without documentation shall be seven years. A longer project life may be used with approval by ARB staff, however, sufficient documentation must be provided to ARB that supports the selected project life based on the actual remaining useful life. The default project life does not consider upcoming regulatory requirements. Project life may be shorter due to regulatory requirements.

B. New Purchase

- Engine purchases for new 2005 or later model year agricultural stationary or portable equipment can only be electric motors.

C. Repower

- A repower of an uncontrolled or emission certified (1996+ model year) diesel engine must be with one of the following:
  - A new electric motor.
  - A new off-road diesel engine certified to the current applicable emission standards.
  - A new off-road spark-ignited (SI) engine certified to the current applicable emission standards.
  - A new SI engine that exceeds local district emission requirements and is subject to and complies with local district permitting, monitoring, record keeping and reporting requirements. This criterion will sunset on January 1, 2008.

- A repower of an uncontrolled SI engine must be with one of the following:
  - A new electric motor.
  - A new off-road SI engine certified to the current applicable emission standards.
  - A new SI engine that exceeds local district emission requirements and is subject to and complies with local district permitting, monitoring, record keeping and reporting requirements. This criterion will sunset on January 1, 2008.

- A repower of an emissions-controlled SI engine must be with one of the following:
  - A new electric motor.
  - A new off-road SI engine certified to the current applicable emission standards.

- A new SI engine that meets or exceeds local district emission requirements and is subject to and complies with local district permitting, monitoring, record keeping and reporting requirements, provided that the new engine provides a NOx emission reduction of at least 15% from the baseline engine NOx emissions. This criterion will sunset on January 1, 2008.

- Electric motors may replace diesel or SI engines. The applicant must have documentation of payment to the local utility company for power installation. This requirement of documentation also applies to new installations.

- Off-road diesel engines must be certified for sale in California and must comply with durability and warranty requirements.

- The use of a non-certified SI engine shall be subject to approval by ARB staff. Emissions testing of a non-certified SI engine shall be conducted using an ARB-approved source testing procedure, such as ARB Test Method 100.

- Non-certified SI engines shall be required to include currently available emission control components such as closed-loop fuel control systems, and three-way catalysts.

- Non-certified SI engines shall be subject to source testing with an ARB-approved testing procedure following local district requirements.

- Non-certified SI engines must be emission tested using a portable analyzer every 1,000 hours of operation and at least annually, or following local district monitoring requirements, whichever is most stringent. The emission tests shall measure NOx and hydrocarbon emissions.

- The costs associated with source testing and monitoring requirements for non-certified SI engines are not eligible for funding.

D. Retrofit

- A retrofit of an uncontrolled diesel engine that reduces NOx must be with a retrofit kit that is verified to reduce NOx or NOx+NMHC emissions to the applicable new engine Tier standard or less for a given engine size.

- A retrofit of an uncontrolled SI engine that reduces NOx must be with a retrofit kit that is verified to reduce NOx+NMHC emissions to the currently applicable standard for off-road large spark-ignited equipment. If this is not feasible, the project must reduce NOx+NMHC emissions to at least 3.0 g/bhp-hr or less.

- A retrofit of an emission-certified (1996+ model year) off-road diesel engine that reduces NOx must be with a retrofit kit that is verified to reduce NOx or NOx+NMHC

emissions by at least 15 percent from the applicable NOx or NOx+NMHC emission standard.

- Reduced-emission retrofit kits must be verified following California test procedures and must comply with durability and warranty requirements.

E. Scrap

- A baseline engine in a repower project must be destroyed by scrapping or drilling a hole in the engine block rendering it inoperable unless prior approval for alternate disposition has been granted by ARB staff. At the discretion of the district, core charges are eligible for funding and, if including, must be part of the cost-effectiveness calculation.

VI. Cost-Effectiveness

Cost-effectiveness methodology and sample project calculations are provided in Appendices C and D. Emission reduction benefits are calculated by comparing the emission levels and operating parameters of the baseline engine and the replacement, reduced emission engine or motor. The emission reductions and cost-effectiveness of an agricultural engine project may be calculated based on annual hours of operation or annual fuel consumption.

VII. Minimum Project Requirements

A. Application

The minimum application information for stationary and portable agricultural engine projects is in Table 10-4. Districts may request additional information from the applicant.

A disclosure must also be included stating that the proposed project has not been funded and is not being considered for funding by another air district, ARB, or any other public agency. Any applicant who is found to have submitted multiple applications for the same project may be banned from submitting future applications to any and all Carl Moyer Program solicitations and may be subject to criminal sanctions. A project funded cooperatively by multiple air districts is eligible for funding if the project parameters are coordinated amongst the participating districts and the project meets all applicable Carl Moyer Program criteria. Applicants are allowed to re-apply for project funding if a previous application has been rejected and is no longer being considered for funding.

Third party applications are not allowed. The owner of the engine must sign and agree to the application. However, a third party (e.g. engine dealer or distributor) may complete an application or part of an application on an owner's behalf. Applications must include a signature section for third parties. The third party signature section must include signature and date lines, and blanks for the third party to list how much they are

being paid, if anything, to complete the application and what source of funds are being used to pay them. To make the Carl Moyer Program accessible to all potential applicants, including applicants that cannot afford to hire third party assistance, districts are encouraged to provide technical assistance to applicants in completing the application.

Table 10-4
Minimum Application Information for Stationary and Portable Agricultural Engine Projects

1. Air District: 2. Applicant Demographics Company Name: Business Type: Mailing Address: Location Address: Contact Number: 3. Project Description Project Name: Project Type: Equipment Function: Subject to District Permitting Requirements? (Y/N) 4. NOx Reduction Incremental Cost-Effectiveness Analysis Basis: (Mileage/Fuel/Hours of Operation) 5. VIN or Serial Number: 6. Application: (Repower, Retrofit or New) 7. Annual Fuel Consumption: 8. Hours of Operation: 9. Old Engine Information Horsepower Rating: Engine Make: Engine Model: Engine Year: 10. New Engine/Motor Information Horsepower Rating: Engine Make: Engine Model: Engine Year: Fuel Type:	11. NOx Emissions Reductions Baseline NOx Emissions Factor (g/bhp-hr): Reduced NOx Emissions Factor (g/bhp-hr): Estimated Annual NOx Emissions Reductions: Estimated Lifetime NOx Emissions Reductions: 12. ROG Emissions Reductions Baseline ROG Emissions Factor (g/bhp-hr): Reduced ROG Emissions Factor (g/bhp-hr): Estimated Annual ROG Emissions Reductions: Estimated Lifetime ROG Emissions Reductions: 13. PM Emissions Reductions Baseline PM Emissions Factor (g/bhp-hr): Reduced PM Emissions Factor (g/bhp-hr): Estimated Annual PM Emissions Reductions: Estimated Lifetime PM Emissions Reductions: 14. Percent Operated in California: 15. Project Life (years): 16. Cost ($) of the Base Engine: 17. Cost ($) of the New Engine/Motor: 18. District Incentive Grant Requested

B. Reporting and Monitoring

Owners of stationary and portable agricultural engines participating in the Carl Moyer Program are required to keep appropriate records during the life of the project. During

the project life, the district has the authority to conduct periodic checks or solicit operating records from the recipient of Carl Moyer Program funds. This is to ensure that the engine is being operated as stated in the project application. The recipient must maintain and update operating records throughout the project life and have them available to the district upon request. Annual records must contain, at a minimum, total actual hours of operations or estimated amount of fuel used from actual fuel receipts. Actual hours of operations are acceptable for an engine equipped with a non-reset hour meter.

Monitoring may be required to comply with district requirements and to ensure the program incentives are being applied toward the project as specified in the application. To ease the tracking of the equipment over the life of the project, a district registration certificate may be issued to the equipment owner.

VIII. References

ARB, 2003. Air Resources Board. Staff Report: Initial Statement of Reasons, Airborne Toxic Control Measure for Stationary Compression-Ignition Engines. http://www.arb.ca.gov/regact/statde/isor.pdf

ARB, 2005. Air Resources Board. Staff Report: Initial Statement of Reasons, Public Hearing to Consider the Large Confined Animal Facility Definition. http://www.arb.ca.gov/regact/lcaf05/isor.pdf

CASS, 2003. California Agricultural Statistics Service. California Agricultural Statistics, 2003. California Agricultural Overview. http://www.nass.usda.gov/ca/bul/agstat/indexcas.htm

Chapter Eleven

LIGHT-DUTY VEHICLES

This is a new chapter that addresses the project criteria for on-road, light-duty vehicle projects under the Carl Moyer Program. The chapter contains a brief overview of the light-duty vehicle emission inventory, current engine emission standards, available control technologies, potential projects eligible for funding, and emission reduction and cost-effectiveness calculation methodologies.

I. Introduction

Light-duty vehicles include passenger cars and light-duty trucks such as pick-up trucks, sport utility vehicles (SUVs), and vans. In 2005, the estimated number of light-duty vehicles in California is over 21 million vehicles. This number is expected to increase to over 23 million vehicles by 2010. Light-duty vehicles are major contributors to California's ozone and particulate matter air pollution. Although emissions from light-duty vehicles are decreasing with the implementation of stricter emission control standards, light-duty vehicles contribute about half of the ozone producing emissions from all on-road vehicles.

II. Emissions

The oxides of nitrogen (NOx), reactive organic gas (ROG), and particulate matter (PM10) emissions from the light-duty fleet are shown in Table 11-1. In addition to these pollutants, light-duty vehicles emit toxic air contaminants and carbon monoxide (CO).

Table 11-1
Statewide Emissions from On-Road Light-Duty Vehicles
(tons per day)

	Population	NOx	ROG	PM10
2005	21,500,000	574	583	29
2010	23,700,000	388	405	32

Older, light-duty vehicles (pre-1990 model years) account for 56 percent of the ROG and 41 percent of the NOx emissions from all light-duty vehicles in 2005 despite accounting for only 19 percent of the vehicle population and less than 13 percent of the vehicle miles traveled (VMT). Generally, these older vehicles emit more pollutants because of less restrictive emission standards and increased wear and tear on drive train and emission control components. Additionally, the subset of older vehicles that are not well maintained has a higher probability of being high emitters. As a result, older vehicles tend to be major contributors to ozone and particulate matter air pollution in California.

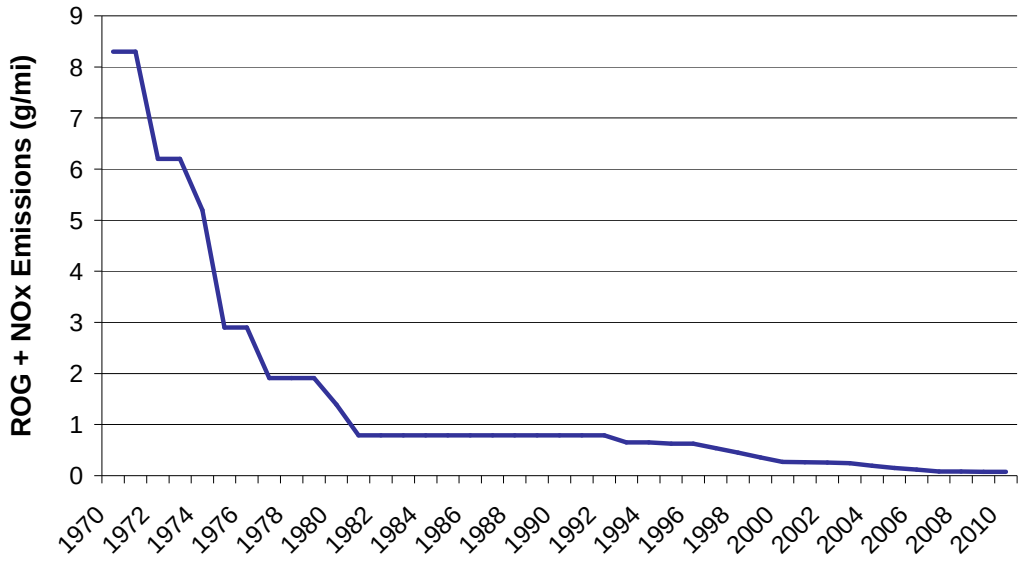
III. Regulatory Requirements

California's emission controls for light-duty vehicles date back to the 1960s. Emission standards have become more restrictive over the years, enabled by new control technologies and cleaner fuels.

Since the 1990s, the Low Emission Vehicle (LEV) regulations have been the cornerstone of the ARB's program to reduce emissions from light-duty vehicles. The LEV program, implemented in 1994, established four tiers of low emission standards and provided manufacturers with the option of certifying their vehicles to any mix of these standards as long as they complied with an average non-methane organic gas annual fleet requirement. The fleet average requirement gradually decreased each year between 1994 and 2003, resulting in the introduction of a greater number of cleaner vehicles each proceeding model year. The LEV II regulation, adopted in 1998, set even more stringent, declining fleet average emission requirements for 2004 through 2010 as well as lowering the NOx emission standards.

Figure 11-1 shows the progressively more stringent emission standards for new light-duty vehicles from 1970 through 2010. As a result of the ARB's LEV program, a new 2005 model year car is on average 99 percent cleaner than an uncontrolled car.

Figure 11-1
Emission Standards for New Light-Duty Vehicles
1970-2010



California also has requirements to ensure vehicles' emission control systems continue to work throughout their lives. Under the Inspection and Maintenance Program (Smog Check), vehicles are tested biennially to ensure that they stay clean as they age. A Smog Check includes a tailpipe emissions test and a visual inspection of the emission control system. For vehicles equipped with on-board diagnostic (OBD II) systems

(model years 1996 and later), the inspection also includes a check of the malfunction indicator light to ensure that no problems have been detected with the vehicle's emission control system.

IV. Potential Projects

Under the general heading of light-duty vehicle projects, the ARB has identified two programs that are eligible for funding under the Carl Moyer Program: voluntary accelerated vehicle retirement (VAVR) and voluntary vehicle repair (VVR). Both programs have the potential to decrease excess emissions from older, high emitting vehicles. These Guidelines will focus on implementing the VAVR program under the Carl Moyer Program. The ARB staff will continue to assess how to incorporate VVR into the Carl Moyer Program and anticipates providing guidance on VVR in 2006. As part of this assessment, the ARB staff will also evaluate extending the guidance to medium-duty vehicles.

A. VAVR Programs

The goal of VAVR programs is to retire older, more polluting vehicles earlier than their expected lifetime, thereby eliminating air pollution emissions associated with their operation. VAVR programs are strictly voluntary programs overseen by the ARB and administered by local air districts. Enterprise operators are contracted by the district and are responsible for evaluating, approving, and disposing of qualified light-duty vehicles. Real emission reductions can be achieved as vehicles are still fully operational and have a useful life remaining. Therefore, to qualify for a VAVR program, a vehicle msut meet registration, functionality, and equipment eligibility criteria. To accommodate car collectors and others with potential interest in vehicles offered for retirement, VAVR programs provide the public with an opportunity to purchase vehicles in whole or in part before the vehicle is entered into the VAVR program. Vehicles accepted into the program for emission reductions must be retired by crushing the vehicle to such a degree that the vehicle and its parts are rendered unusable.

B. Legislative and Regulatory History of VAVR

Vehicle scrapping programs were first introduced in California in the early 1990s. In the 1994 State Implementation Plan (SIP), the ARB included a measure calling for a vehicle scrapping program in the South Coast Air Basin. Senate Bill 501 (Calderon, 1995) directed the ARB to adopt a regulation governing VAVR which would include market-based, privately-operated VAVR enterprises and the generation of emission reduction credits. (See California Health and Safety Code sections 44100-44122, in part.) The ARB adopted VAVR regulations in 1998 and amended these regulations in 2002 [ARB, 1998 and ARB, 2001]. In 1998 and 1999, the ARB conducted a pilot program for retiring light-duty vehicles in the South Coast Air Basin. While the results of the pilot program were encouraging, funding limitations did not permit expansion of the program to achieve the emission reductions called for in the SIP.

The 2003 SIP did not contain an explicit commitment to vehicle retirement because sufficient funding for such programs had not been secured. However, the SIP did acknowledge the need to provide incentives for VAVR programs in the long term. Legislative changes to the Carl Moyer Program enacted with the signing of Assembly Bill 923 (Firebaugh, 2004) added light-duty vehicle projects to the list of allowable projects and provided additional means of funding VAVR programs to reduce NOx, ROG, and PM10 emissions.

C. District VAVR and the BAR Vehicle Retirement Programs

Four districts have recently operated or continue to operate VAVR programs including the Bay Area Air Quality Management District (AQMD), San Diego Air Pollution Control District (APCD), Santa Barbara APCD, and South Coast AQMD. Between 2000 and 2003, these districts scrapped over 21,000 vehicles or over 5,000 vehicles per year.

In addition to district VAVR programs, the Bureau of Automotive Repair's (BAR) Smog Check Program includes a voluntary vehicle retirement element. As part of BAR's Consumer Assistance Program, owners of qualifying vehicles that fail the biennial inspection are given the option of voluntarily retiring their vehicle rather than repairing it. BAR offers $1,000 in exchange for the vehicle.

District VAVR programs work outside of BAR's Smog Check Program to ensure that district programs generate emission reductions that are surplus to the those obtained through the Smog Check. BAR's program covers vehicles that have failed their biennial Smog Check while the district programs cover vehicles that have passed their biennial Smog Check or are "off cycle" for Smog Check (i.e., not due for their biennial inspection). To ensure that the two programs do not compete with one another, vehicles that are within 60 days from their next required Smog Check must pass the Smog Check inspection under the VAVR regulation. If the vehicles are between 61 to 90 days of the next Smog Check, the district must verify that the vehicle has not failed the Smog Check inspection before the vehicle can be accepted. Additionally, the vehicle cannot be operating under either a BAR repair cost waiver or economic hardship extension.

D. Remote Sensing

Studies by the ARB, BAR, the U.S. Environmental Protection Agency (U.S. EPA), and the University of Denver, Colorado, among others, have shown that remote sensing devices (RSD) can be effective tools in identifying high emitting vehicles [BAR, 2001; U.S. EPA; Stedman, 1994; and Stedman].

Remote sensing typically uses infrared and, at times, ultraviolet spectroscopy to measure the concentrations of air pollutants in vehicle exhaust while the vehicle is in use on the roadway. Concentrations of ROG, NOx, and CO in parts per million or percent are recorded along with the vehicle's speed and rate of acceleration and a photo of the license plate.

The ARB staff is proposing to include the option of using RSD to identify high emitting vehicles that can then be contacted for participation in voluntary early retirement programs. Staff is taking a two-step approach to integrate RSD into the Carl Moyer Program and the VAVR regulation. As a first step, the ARB would authorize an RSD-based "High-Emitting Vehicle Identification, Repair, and Scrapping Program" to be run by the South Coast AQMD starting in Spring 2006. Then, the ARB would use the data from this program to revise the VAVR regulation and provide additional Carl Moyer Program guidance in 2006 to fully incorporate RSD. The revisions would codify the use of RSD; establish protocols for quantifying emission reductions; and determine the appropriate application of Moyer funds to RSD-based VAVR programs. As part of this guidance, the ARB would evaluate what elements related to the use of RSD would be eligible for funding under the Carl Moyer Program consistent with legislative requirements and Board direction. After the ARB revises the regulation and Carl Moyer Program guidance, any district may develop and implement an RSD-based VAVR program.

The South Coast project will mark the first time an RSD-based VAVR program has been implemented. Because the methodology for calculating the emission reductions associated with retiring or repairing high-emitting vehicles has not been established and the level of vehicle owner participation cannot be predicted in advance, the cost-effectiveness of the program cannot be fully established in advance. Carl Moyer Program funds can only be used for projects that meet the $14,300 per weighted ton cost-effectiveness limit. By undertaking this introductory RSD program, the South Coast Air District is taking some risk if the program ultimately exceeds the cost-effectiveness limit.

V. Proposed Project Criteria

Light-duty vehicle projects will initially be limited to VAVR programs that meet the ARB's VAVR regulations. As noted above, the proposed Guidelines also provide for an RSD implementation program in the South Coast. The project criteria listed below provide districts with the minimum qualifications for the Carl Moyer Program.

The criteria listed below highlight many, but not all, of the requirements of the ARB's VAVR regulation. VAVR programs must meet all of the requirements of the regulation. Districts starting VAVR programs using Carl Moyer Program funding should reference these Guidelines as well as the regulation. Where the Carl Moyer Program Guidelines go beyond the requirements of the regulation, it is noted below. Participating districts retain the authority to impose additional requirements to address local concerns.

A. General Requirements

- Emission reductions obtained through Carl Moyer Program projects must not be required by any federal, state, or local regulation; memorandum of

agreement/understanding with a regulatory agency; settlement agreement; mitigation requirement; or other legal mandate.

- Projects must meet a cost-effectiveness of $14,300 per weighed ton of NOx + ROG + combustion PM10 reduced calculated in accordance with the cost-effectiveness methodology discussed in this chapter.

- No emission reductions generated by the Carl Moyer Program shall be used as marketable emission reduction credits or to offset any emission reduction obligation of any person or entity.

- Projects must have a minimum project life of three years. The ARB may approve shorter project life on a case-by-case basis. Projects with shorter lives may be subject to additional funding restrictions, such as a lower cost-effectiveness limit or a project cost cap. The contract term must extend to the end of the project life. The default project life does not consider upcoming regulatory requirements.

- Potential projects that fall outside of these criteria may be considered on a case-by-case basis if evidence provided to the ARB suggests potential surplus, real, quantifiable, and enforceable emission reduction benefits.

- Air districts must consult with ARB staff to determine eligibility of all projects considered for funding on case-by-case basis. All projects considered on a case-by-case basis must receive ARB approval prior to receiving program funding.

- Participation in a light-duty VAVR program shall be entirely voluntary for vehicle owners.

- VAVR programs shall comply with all provisions of the VAVR regulations found in Title 13 California Code of Regulations, Division 3, Chapter 13, Article 1, section 2601 et seq.

- VAVR programs seeking funding under the Carl Moyer Program shall comply with all applicable provisions of the Carl Moyer Program Guidelines including "Administration of the Carl Moyer Program."

- Funding of program administrative costs, including advertising or outreach, shall be limited to the amount allowable under statute.

B. Vehicle Eligibility Requirements

- The vehicle to be retired must be currently registered with the Department of Motor Vehicles (DMV) as an operating vehicle and must have been registered for at least 24 consecutive months prior to the final date of the sale to a VAVR enterprise to an address, or addresses, within the district in which the VAVR enterprise is operated.

Smog Checks must be performed as required by the DMV in order for the vehicle to be considered registered.

1. A vehicle may also be eligible if the owner of the vehicle placed the vehicle in planned non-operational status per Vehicle Code section 4604, et seq., for a total of 2 months during the continuous 24 month registration period, occurring at least 3 months prior to the date of sale to the VAVR enterprise.

2. A vehicle may also be eligible if the registration has lapsed for a period not to exceed 180 days during the previous 24 months and all appropriate registration fees and late penalties have been paid to the DMV, provided that the vehicle is registered for at 90 days immediately prior to its date of sale to a VAVR enterprise.

NOTE: These eligibility requirements are stricter than the ARB's current VAVR regulation but are consistent with the requirements of Health and Safety Code section 44094.

- The vehicle to be retired shall be driven to the VAVR enterprise purchase site under its own power and shall pass a functional and equipment eligibility inspections as specified in the ARB's VAVR regulation.

- The vehicle to be retired shall not be operating under a Smog Check repair cost waiver.

- If a vehicle volunteered for retirement is within 60 days of its next required Smog Check inspection, the vehicle shall pass the Smog Check inspection without receiving a repair cost waiver or economic hardship extension prior to acceptance by a VAVR enterprise operator.

- If a vehicle volunteered for retirement is within 61-90 days of its next required Smog Check inspection, the district shall verify that the vehicle has not failed a Smog Check inspection during this time frame.

C. Calculating Emission Reductions

- Emission reductions from VAVR programs shall be calculated in accordance with the methodology specified in the ARB's VAVR regulations. Emission reductions, by model year of vehicle retired, are shown in Table 11-2. (The table is also included in Appendix B, Tables for Emission-Reduction and Cost-Effectiveness Calculations, at Table B-21.)

- The project life for a vehicle retirement project is three years as specified in the ARB's VAVR regulation.

D. Offering Vehicles/Parts to the Public

- The enterprise operator must inform the district of the vehicles that are ready for dismantling.

- The district must provide a detailed description of the vehicle to interested parties including collectors and enthusiasts.

- The enterprise operator must wait a minimum of 10 days before submitting a Notice to Dismantle to the DMV.

- If an interested person contacts the enterprise operator, the enterprise operator must hold the vehicle for an additional, minimum of 7 days.

- Non-emission-related and non-drive train parts from the vehicle may be sold at the sole discretion of the enterprise operator.

- Engine, emission-related parts, transmission, and drive train parts must be removed from the vehicle and destroyed after the 10 day waiting period but prior to offering the remaining parts for sale. (Emission-related and drive train parts are defined in the VAVR regulation.)

- If a vehicle or its emission-related or drive train parts are sold instead of retired, no emission reductions will be generated, and Carl Moyer Program funds may to be used for retiring the vehicle.

E. Recordkeeping

- For each vehicle retired, the district shall retain the following information:

    1. Vehicle Identification Number (VIN).
    2. Vehicle license plate number.
    3. Vehicle model year.
    4. Vehicle odometer reading.
    5. Vehicle make and model.
    6. Name, address, and phone number of legal owner selling vehicle to the enterprise operator.
    7. Name and business address of inspector conducting the vehicle's eligibility inspection, if the VAVR enterprise operator contracts with an ARB-approved inspection entity to perform the vehicle functional and equipment eligibility inspection.
    8. Date of purchase of vehicle by enterprise operator.
    9. Date of vehicle retirement.
    10. Emission reduction claimed.

- The VAVR enterprise operator shall maintain the following:

1. Reproduction of California Certificate of Title and registration, as signed-off by the seller at time of final sale to the VAVR enterprise.
2. Reproduction of the applicable certificate of functional and equipment eligibility;
3. Reproduction of the applicable Notice to Dismantler (DMV Registration 42 form).
4. Reproduction of written documentation from the DMV verifying that a vehicle meets the vehicle registration requirements of the ARB's VAVR regulations.
5. If the retired vehicle was within 60 days of its next required Smog Check inspection, a reproduction of documentation that the vehicle passed its Smog Check inspection.

- Districts and enterprise operators shall retain these records for the life of the project plus an additional three years.

  NOTE: This requirement is stricter than the ARB's current VAVR regulation which requires that records be maintained for the life of the project but is consistent with the Carl Moyer Program administrative requirements.

F. Criteria for South Coast AQMD RSD/Scrapping/Repair Project

- The South Coast AQMD may operate an RSD-based high-emitting vehicle identification, repair, and scrapping program.

- Prior to project implementation, the district shall submit a detailed project plan for approval by the ARB's Executive Officer (EO).

  1. The plan shall include a detailed protocol describing the installation, calibration, and operation of RSD that will be used to identify high emitters along with the methodology for processing of the data collected.
  2. The plan shall include itemized, estimated project costs including, but not limited to, the funds allocated to vehicle repair and the number of vehicles to be repaired; the funds allocated to vehicle retirement and the number of vehicles to be retired; and the costs allocated to RSD data collection, data analysis, outreach, and solicitation of vehicle owners.
  3. The plan shall include a sample of the letter that the South Coast AQMD intends to send to vehicle owners soliciting their voluntary participation in the project.
  4. The project must follow the plan, and any substantive changes must be pre-approved by the EO.

- The South Coast AQMD shall permit the ARB to perform emissions testing on a subset of the retired vehicles selected by the ARB prior to dismantling.

- As part of the Carl Moyer Program reporting requirements, the South Coast AQMD shall report on each vehicle retired or repaired under this program.

- The ARB may conduct periodic auditing of the program, and the South Coast AQMD shall provide any required information concerning the program.

- If vehicle records are missing, incomplete, or chronically late, the ARB may disallow emission reduction credit for that vehicle.

- The ARB has not yet established the methodology for calculating the extra emission benefits from retiring high-emitting vehicles identified using RSD. Because of this, the emission reductions achieved under this project shall be calculated in accordance with a new methodology that will be established during the next revision of the VAVR regulation.

- An acceleration simulation mode (ASM) Smog Check test must be run on all vehicles being retired or repaired during this introductory RSD/scrapping/repair project to help establish the emission reduction calculation methodology.

VI. Emission Reduction and Cost-Effectiveness Calculations

For VAVR projects, the emission reduction benefits represent the difference in the emission levels of the retired vehicle and the replacement vehicles. The ARB approved the methodology for calculating emission reductions associated with VAVR at its December 1998 Board meeting [ARB, 1998]. Emission reductions, by model year of vehicle retired, calculated in accordance with the approved methodology are listed in Table 11-2. The table lists the reductions over the full three year life of a vehicle retirement project. The methodology for retiring high-emitting vehicles identified via RSD has not yet been established.

A detailed description of how to calculate cost-effectiveness can be found in Appendix C: Cost-Effectiveness Calculation Methodology and Appendix D: Example Calculations.

Table 11-2
Voluntary Accelerated Light-Duty Vehicle Retirement Program
Emission Reductions for Calendar Year 2006*
Total Pounds Per Vehicle Over 3 Year Credit Life

	Emission Reductions (pounds) – 3 Year Credit Life			
Model Year	**NOx**	**ROG****	**CO**	**PM10**
65 and earlier	151	496	2,757	0.68
66	145	471	2,552	0.67
67	148	477	2,611	0.65
68	156	492	2,731	0.81
69	162	504	2,841	0.56
70	169	438	2,971	0.99
71	172	449	2,990	0.95
72	177	458	3,037	0.83
73	180	469	3,082	0.64
74	159	401	2,859	1.20
75	145	345	2,861	1.17
76	130	222	2,673	1.04
77	108	183	2,546	1.13
78	107	186	2,493	1.10
79	95	168	1,625	0.90
80	85	129	1,373	1.13
81	62	108	1,092	1.22
82	66	101	1,085	1.36
83	73	85	934	1.22
84	73	74	883	1.05
85	69	59	575	0.89
86	71	61	527	0.91
87	67	71	468	0.92
88	67	65	430	0.85
89	50	46	492	0.84
90	38	45	529	0.81
91	38	42	514	0.76
92	40	41	510	0.71
93	35	31	279	0.64
94	19	17	21	0.54

* Table is repeated in Appendix B, Table B-21
** Includes exhaust and evaporative emissions

Source: EMFAC2002, Version 2.2, statewide, annual average. Assumes average 1965 through 2006 vehicle as replacement vehicle for vehicles retired in calendar year 2006.

This table updates the emission reductions provided in the ARB's VAVR regulation consistent with the methodology in the staff report, Proposed Regulations for Voluntary Accelerated Light-Duty Vehicle Retirement Enterprises, released October 23, 1998, and approved by the ARB on December 10, 1998.

VII. Minimum Project Application Requirements

Districts must submit a VAVR plan to the ARB, consistent with the Carl Moyer Program Guidelines. The district must receive written approval of the plan from the ARB's EO prior to implementing the VAVR program under the Carl Moyer Program. The district must also follow all other Carl Moyer Program reporting requirements.

The district plan must at a minimum include:

1. The name, title, and telephone number of the district contact for the VAVR program.
2. An evaluation of environmental justice considerations including, but not limited to, outreach addressing community needs.
3. An estimate of the number of vehicles that may be retired and an estimate of the cost-effectiveness of the program along with all assumptions and calculations that were used to derive the estimate (recognizing that the ultimate cost-effectiveness will depend on the mix of vehicles actually retired).
4. A sample of the enterprise operation contract.
5. A description of the methods that will be used and a timetable for monitoring and auditing enterprise operations.
6. A copy of the statement of certification that an enterprise operator has demonstrated compliance with all applicable provisions of the regulation.
7. The methodology and sample records for verifying that a vehicle is eligible for inclusion in the VAVR program including confirmation of compliance with any Smog Check requirements.
8. The protocol for informing the public of the availability of eligible vehicles for sale.
9. A sample of the records that will be required of the enterprise operator.
10. A description of changes to the VAVR program that are more stringent than those listed in the statewide regulation (if a district chooses to adopt requirements beyond those required).
11. Any additional information necessary to explain or clarify how the district plan complies with the VAVR regulation and the Carl Moyer Program.

The annual report shall contain, for each vehicle retired, at a minimum:

1. Vehicle Identification Number (VIN).
2. Vehicle license plate number.
3. Vehicle model year.
4. Vehicle odometer reading.
5. Vehicle make and model.
6. Name, address, and phone number of legal owner selling vehicle to the enterprise operator.
7. Name and business address of inspector conducting the vehicle's eligibility inspection, if the VAVR enterprise operator contracts with an ARB-approved inspection entity to perform the vehicle functional and equipment eligibility inspection.
8. Date of purchase of vehicle by enterprise operator.
9. Date of vehicle retirement.

10. Emission reductions claimed.

VIII. References

ARB, 1998. Air Resources Board, Proposed Regulations for Voluntary Accelerated Light-Duty Vehicle Retirement Enterprises, October 23, 1998.

ARB, 2001. Air Resources Board, Proposed Amendments to Air Resources Board Voluntary Accelerated Vehicle Retirement Regulations – Minimize the Differences Between ARB and BAR VAVR Regulation and Allow Parts Recycling and Resale of Non-Emission-Related and Non-Drive Train Parts, November 30, 2001.

BAR, 2001. Bureau of Automotive Repair, Remote Sensing Device High Emitter Identification with Confirmatory Roadside Inspection, Final Report 2001-06, August 30, 2001.

U.S. EPA. Julian W. Jones, C. Ted Ripberger, and Niranjan Vescio, U.S. Environmental Protection Agency, Office of Research and Development, FINAL REPORT An Investigation of Remote Sensing Devices for Chemical Characterization of Motor Vehicle Exhaust.

Stedman. Donald H. Stedman and Gary A. Bishop, Department of Chemistry and Biochemistry, University of Denver, Colorado, Emissions-Based Mobile Source Inventory Methods.

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Chapter Twelve

ZERO-EMISSION TECHNOLOGIES

This is a new chapter that highlights some of the available zero-emission technologies eligible for Carl Moyer Program funding. It provides more detail on zero-emission technologies and, for some project types, provides additional project criteria. It also describes emission reduction and cost-effectiveness calculation methodologies. This chapter is a supplement to other chapters in these Guidelines: it does not replace or supersede any other criteria.

I. Introduction

A. Benefits of Zero-Emission Projects

Zero-emission technology is a key element of California's long-term plan for attaining health-based air quality standards. Electric motors are the most commercially viable zero-emission technology available today. In general, replacing internal combustion engines with electric motors provides major reductions in oxides of nitrogen (NOx) and particulate matter (PM10). Zero-emission technologies also have a number of societal benefits that re not quantified in the Carl Moyer Program. These include reductions in toxic air contaminants, greenhouse gases, petroleum consumption and noise pollution. In addition, electricity production does not have as many “upstream” emission impacts as the production of combustible fuels. Refining, storage and delivery all have associated emissions from routine operations and accidents (e.g., fuel spills). Furthermore, unlike other technologies with emission control devices that may lose effectiveness over time, with zero-emission equipment there is no emission rate deterioration. Electric equipment will remain emission-free throughout its useful life.

Although the purchase price of electric equipment can be higher than comparable internal combustion engine equipment, owners and operators generally realize significant fuel and maintenance cost savings. The higher purchase price is sometimes recouped through these savings during the life of the equipment. Higher salvage values and longer lives can provide electric equipment with an economic advantage compared to internal combustion engine equipment. In addition, electric equipment operators sometimes derive indirect benefits from privileges like access to restricted areas, use of carpool lanes and even public relations benefits.

Yet, despite these attributes and the fact that electric technologies may be well-suited for a multitude of applications, there have been relatively few zero-emission projects funded by the Carl Moyer Program. Many prospective buyers still perceive electric equipment to be an unfamiliar, risky technology or are deterred by the higher initial investment. The Carl Moyer Program can address both of these issues, first by serving as a source of information regarding electric technologies and, second, by providing grants to help offset increased costs. Zero-emission projects should become

increasingly competitive within the Carl Moyer Program. New regulations, tighter emission standards, increasing petroleum prices, and technology advances are helping to make zero-emission technologies more competitive. As regulatory requirements continue to decrease baseline emission levels, Carl Moyer Program applicants need to find cleaner technologies to qualify for funding.

The Air Resources Board (ARB) staff is proposing to require that districts encourage zero-emission projects. This encouragement can be demonstrated in a number of ways. Districts operating on a "first-come-first-served" basis may rotate zero-emission projects to the top of the list, regardless of when the applications were submitted. Districts that solicit projects and rank them by cost-effectiveness may choose to fund zero-emission projects first, regardless of their cost-effectiveness (as long as the project does not exceed $14,300 per weighted ton). Alternatively, districts may earmark a percentage of their allocation for zero-emission projects or increase outreach efforts that target zero-emission projects. Any of these strategies are acceptable, as well as other means of encouragement. Districts' policies and procedures must describe how they plan to encourage zero-emission technologies.

B. Types of Zero-Emission Projects

To date, the Carl Moyer Program has funded approximately 231 electric forklifts, 55 hybrid-electric buses, 7 electric motor driven agricultural pumps, and 4 electric battery hybrid locomotives. In addition, 30 truck stop spaces are scheduled to be equipped with IdleAire systems to reduce truck idling under the Carl Moyer Program. In all of these projects, the NOx-only cost effectiveness is very favorable. These projects will be even more cost-effective when reactive organic gases (ROG) and combustion PM are taken into account with the proposed new weighted cost-effectiveness formula. Zero-emission projects have an inherent emissions advantage because there is no NOx versus PM trade-off (as with some diesel projects) and no additional cost for controlling PM or ROG.

In addition to agricultural pumps, buses, locomotives, and forklifts, there are several other applications where zero-emission technologies are capable of replacing combustion engines. Marine ports, airport ground support equipment (GSE), and industrial equipment are all good candidates for zero-emission technology. In addition, electric motors can substitute for idling trucks and engines used for truck refrigeration units. All these applications are eligible for the Carl Moyer Program funding, and zero-emission technologies are the cleanest option.

In the following section, we discuss the availability and provisions for using zero and near-zero emission technologies. For new applications of zero-emission technologies not addressed elsewhere in the Guidelines, such as truck parking space electrification, we outline the parameters for Carl Moyer Program eligibility. Although many of these projects will be assessed on a case-by-case basis at this time, our intent is to provide a general framework for evaluation. As with all projects, emission reductions must be

surplus, real, quantifiable, and enforceable and the project must meet the cost-effectiveness threshold of $14,300 per weighted ton.

Most Carl Moyer Program projects can simply substitute an electric motor for an internal combustion engine. In those cases, the same criteria and methodologies apply as for a typical repower or new purchase, except as noted in the criteria section of this chapter. All relevant regulations and MOUs discussed or referred to in the respective chapters also apply to zero-emission projects. The only difference is that the new or replacement piece of equipment has no emissions.

II. Regulatory Requirements

Regulatory requirements that apply to the baseline equipment are included in the respective chapters pertaining to the category of equipment under consideration. Because there are no regulatory requirements for Carl Moyer Program categories that mandate zero-emission technologies, emission reductions resulting from using such technologies will always be surplus.

III. Potential Zero-Emission Projects

A. Electrically-Driven Agricultural Equipment

Agricultural equipment, such as pumps, provides an ideal application and the potential for wide-scale deployment of a zero-emission technology. Statewide, several thousand internal-combustion engines are used for pumping water for agricultural purposes. To date over 2,000 pumps have been replaced using Carl Moyer Program funds, all but a few of those replacements were with diesel engines. Farmers are reluctant to purchase electrically driven pumps for several reasons but the high cost of installing infrastructure and unpredictable electricity rates have been the primary deterrents to purchasing electric motor pumps. In addition, farmers usually have to pay substantial fixed charges for electricity even when the electric pump is not used. Because of these issues, most farmers opt for diesel pumps.

A new utility company incentive program coupled with Carl Moyer Program funding provides an opportunity to go electric. Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) have developed a rate-based incentive program that helps make electric motor irrigation pumps cost-competitive with diesel pumps. These new incentive rates, which have been approved by the Public Utility Commission, are structured with the intent to achieve cost parity between owning and operating electrically driven agricultural pumps and diesel pumps capable of equal output. The rates were developed with a diesel price assumption of $1.15 per gallon. The rates are guaranteed to remain fixed (with the exception of a one and one half percent annual increase) until the year 2015. With current diesel prices more than double the assumed $1.15 price, electrically driven pumps should prove a viable economic option to diesel-powered pumps. The PG&E and SCE incentive programs are first-come-first-served programs that are accepting applications through July 31, 2007.

The PG&E and SCE incentive programs also provide funding to partially or fully offset the cost of extending power lines to the pump sites and eliminate the fixed demand charge, so customers do not have to pay a fee for the months that the pump is not operated. Carl Moyer Program funding coupled with the PG&E and SCE incentive programs can provide lower electricity rates, price stability, infrastructure subsidies and waived demand charges, making electric motor pumps a very attractive option.

In order to qualify for the PG&E or SCE incentive program, the applicant must replace an internal combustion engine (excluding those fired with natural gas) used for irrigation pumping which was installed and operational prior to September 1, 2004. In addition, the replaced engine must be destroyed or, if purchased with Carl Moyer Program funds, surrendered, destroyed, relocated or removed as instructed by the ARB and the local air district. ARB staff is proposing that all Tier 1 engines originally funded by the Carl Moyer Program that are replaced through the PG&E or SCE incentive program be destroyed as described in the Administration Chapter (Chapter Two, Part I of the Proposed Carl Moyer Program Guidelines). Staff further proposes that Tier 2 engines currently under Moyer contract be relocated to replace a dirtier engine within the air district; the dirtier engine must then be destroyed. Districts should conduct pre-inspections to ensure the dirtier engine is operational, and post-inspections to ensure that the replacement Tier 2 engine is properly installed and functioning.

Districts may allow the sale of Tier 2 engines that are replaced through the PG&E or SCE incentive program within the district if documentation is provided to establish the chain-of-custody of the engine, and the sale price. If the district allows the sale of Tier 2 engines, all proceeds from the sale must be divided between the applicant and the district based upon the ratio of original funding provided for the purchase of the Tier 2 Moyer engine. Funds returned to the district must be spent on Moyer eligible projects (funds may be used to offset the added cost of the pre- and post-inspections). If the Tier 2 engine cannot be relocated within the district, it must be destroyed.

Because the PG&E and SCE incentive programs are a limited time offer, the ARB staff is proposing to allow pump engines currently under Carl Moyer Program contract to be replaced with electric motors under the incentive programs, with the contract to be revised to reflect the use of an electric motor. The remaining project life of the initially funded engine project would be added to the project life for the new electric motor pump project. The increased project life would be used in the cost-effectiveness calculation, and the contract duration will be increased accordingly.

For replacement agricultural pump engines not currently funded by the Carl Moyer Program, ARB staff proposes to allow applicants to use one-half of the normal rebuild cost for the baseline cost. Normally, Carl Moyer Program participants apply for grants at the time an engine needs to be rebuilt. In these cases, the grower would pay the base rebuild cost, while the Program would fund the incremental cost of a repowering with a newer, cleaner engine. Because the PG&E and SCE incentive programs are a limited time first-come, first-served offer, some growers may choose to replace their

engines with an electric motor before the normal rebuild interval for their engine. Because it will be difficult to determine where each individual engine is in its rebuild cycle, ARB staff proposes to assume that all engines taking advantage of the PG&E and SCE incentive programs are halfway through their rebuild cycle – and that the applicant's base cost would be half the rebuild cost.

Carl Moyer Program applicants using the PG&E and SCE incentive programs will also have to make adjustments to the emission reduction calculations. Because to date virtually no electric agricultural pump projects have been funded through Carl Moyer Program grants, the PG&E and SCE incentive programs take credit for the emission reduction between a Tier 3 engine and an electric motor. As a condition of the PG&E and SCE incentive programs, these emission reductions must be donated to the Carl Moyer Program for clean air. The emission reduction benefit between the replaced engine and a Tier 3 engine, may be included in the cost-effectiveness calculation to determine the grant amount. An example of this calculation is provided in Appendix D.

Proposed Project Criteria for Electrically Driven Agricultural Equipment

- Purchases of new 2005 or later model year agricultural equipment can only be electric motors.

- Priority must be given to projects that replace stationary agricultural engines with electric motors.

- Agricultural equipment that use an electric motor may use a default 10 year project life for calculating cost-effectiveness.

- Costs for necessary peripheral equipment associated with the motor (e.g., control panel, motor leads, service pole with guy wire, and connecting electric line) may be included in the grant award amount.

- District match funds may be used for infrastructure purchase and installation.

- District match funds may be used to offset the higher cost of electricity relative to diesel fuel, if applicable. In this case, the fuel cost difference will be accounted for when calculating the cost-effectiveness of the project.

- All electric-driven equipment must have a functioning kilowatt-hour meter, or other method approved by the local air district, to monitor usage.

B. Marine Shore-Side Provided Power

In addition to being the largest source of air pollution in many districts, ports are often situated in environmental justice areas. For these reasons, ports are a primary focus for emission reduction strategies throughout the state. Governor Schwarzenegger has directed state and regional air agencies to work together with the U.S. Environmental

Protection Agency, industry and community stakeholders to address port-related sources of air pollution.

The largest emission source at ports is marine vessels. One strategy for reducing marine vessel emissions is "cold ironing" where ships plug into shore-side power while docked, rather than continuously running their diesel engines to generate electricity. Cold-ironing requires the proper electrical supply connections from the shore — lines, transformers, switching gear, cables, etc. — and the necessary hook-ups on the ship.

Cold ironing, long used for naval vessels, has recently been implemented in the non-military sector in Juneau, Alaska and at the Port of Los Angeles. Four specially-equipped cruise ships plug into shore-side power in Juneau during hotelling operations, while a container vessel plugs in at the electrified berth in Los Angeles. In addition, the Port of Long Beach has begun work to provide dockside electricity to accommodate two retrofitted oil tankers and work has begun in Seattle to convert a berth for cruise ships. Other ports in the U.S. and worldwide are also considering cold-ironing. Early results of ARB's shore-electrification feasibility study indicate that cold-ironing is a cost-effective measure to reduce pollutants from a variety of ships — namely, cruise ships, container ships, and refrigerated bulk ships — at several California ports.

Most marine projects in the Carl Moyer Program deal with harbor craft. Cold ironing projects go beyond harbor craft and include cruise ships, tankers, and freighters. Because cold ironing is a nascent technology, it is difficult to specifically identify the exact components that will be eligible for Carl Moyer Program funding. Because each cold ironing project will be unique, ARB staff is proposing that they be considered for grant funding on a case-by-case basis. The cost-effectiveness and grant amount will depend on a number of issues such as interface compatibility, operating voltage, energy needs and electricity availability at the dock. However, evidence must be submitted to the air district to prove that all emission reductions are surplus, real, quantifiable, and enforceable and the cost-effectiveness limit is not exceeded**.** Applications will be evaluated based on factors including, but not limited to, frequency and duration of port visitations, energy usage at the dock, seasonal operating variances and regularity of travel routes.

C. Forklifts and Other Large Spark-Ignition Equipment

The Carl Moyer Program has two general emission control strategies for forklifts -- (1) purchase of new electric forklifts instead of new internal combustion engine (ICE) forklifts; and (2) retrofit or repower of internal combustion forklifts that do not lend themselves to electric substitution. Specific project criteria for funding large spark-ignition (LSI) engines are not yet formalized in these proposed Carl Moyer Program Guidelines pending the Board's action in late 2005 on the staff's proposed regulations for LSI engines and equipment. Chapter Six provides additional background discussion on this project category and potential criteria that could be used to establish funding eligibility under the Carl Moyer Program for both strategies. Staff is proposing that until

the Board adopts the LSI regulation, districts may continue to fund forklift projects using the 2003 Carl Moyer Program Guidelines. During this interim period, additional zero-emission LSI projects may be considered on a case-by-case basis.

D. Airport Ground Support Equipment

Electric GSE have several attributes that make them appeal to users. Participants of demonstration and fleet conversion programs like the way that electric GSE handle and appreciate the fact that they are more "task specific". Battery weight often provides valuable ballast needed to lift heavy objects or push airplanes; usage is often conducive to charging cycles; there are no odors; and no liquid fuel required in the aircraft staging area. Most importantly, electric GSE can be cost-effective and generally have relatively short payback periods. Electric GSE are commercially available and commonly used for a number of equipment types including belt loaders, baggage tractors, aircraft tugs, lifts, ground power units, cargo loaders, lavatory carts and air-start units. However, the higher capital cost of electric equipment is often a deterrent to prospective buyers. Carl Moyer Program funds can be used to offset this initial capital investment.

As discussed in Chapter Seven, there are currently no regulations requiring the use of electric ground support equipment (GSE) at airports but there is a Memorandum of Understanding that involves five airports in southern California (Los Angeles, Ontario, Orange County, Burbank, and Long Beach). The Carl Moyer Program will fund the purchase of new electric GSE instead of new GSE powered by internal combustion engines if this equipment is surplus to the MOU; is not used to meet the requirements of any regulation, including the upcoming large-spark ignition regulation; is not funded through any other incentive program; and is not used to generate credits of any type.

E. Idling Reduction Technologies

Truck drivers idle their propulsion engines for a number of reasons but the main purpose is for interior climate control -- heating and cooling the cab/sleeper compartment of the truck. A pilot survey on truck idling trends conducted in Northern California indicates that 67 percent of idling is to provide heating and 83 percent for air conditioning [Brodrick et al., 2001]. Therefore, devices capable of providing heating and air conditioning without operating the propulsion internal combustion engine may substantially reduce emissions associated with truck idling. ARB staff proposes such devices be eligible for funding in the Carl Moyer Program.

Idling emissions, as well as fuel consumption, can be reduced by installing an available zero-emission idling control technology such as an on-board non-internal combustion engine device; by using a site-specific off-vehicle technology such as IdleAire; or by combining on and off-vehicle technologies.

Available zero-emission on-vehicle technologies include generators or upgraded alternators coupled with inverter/chargers and electric heating ventilation and air conditioning (HVAC) systems. On-board battery packs or fuel cells are also an option.

Off-vehicle technologies include grid-supplied electricity at truck stops and advanced truck stop electrification (e.g., IdleAire). The use of these devices, in lieu of operating the heavy-duty engine at idle, will result in significant NOx reductions. Reductions in PM and ROG are also expected but to a lesser extent depending on the type of alternative idle reduction device/strategy used.

In October 2005, the Board will consider a proposal that would limit idling of heavy duty trucks equipped with sleeper berths. This proposal would prohibit heavy duty trucks with sleeper berths from idling more than five minutes unless certain conditions are met. If the Board approves the staff recommendations, the baseline for calculating the benefits of truck idle reduction projects would be a certified diesel APU. Zero-emission technologies would be eligible for funding using the lower emission baseline.

1. Idling Reduction Technology Options

Because the vast majority of truck idling occurs away from truck stops, the most effective idle reduction technologies are those that are available to meet operator needs at any location idling occurs. The costs of these technologies vary widely, although the initial capital investment can typically be recovered within one to three years from reduced fuel and maintenance savings. Still, truck owners and operators have not been receptive to these solutions because of their higher initial cost.

Another on-board idle reduction system utilizes electric heating, ventilation, and air conditioning (HVACs) instead of internal combustion engine-driven HVACs. These electric HVACs can be powered directly from the grid, a fuel cell, or from energy stored in battery packs. The battery packs can be charged from the grid, from the truck's alternator, or from a small on-board gen-set. Fuel cells are an emerging zero-emission technology that may also substitute for idling truck engines or auxiliary power units in the future.

ARB staff proposes to continue to help defray the initial cost of equipping the truck with the necessary idle-reducing electric equipment. The Carl Moyer Program would pay up to $5,500 toward electric equipment and up to $3,400 for its installation. In order to be eligible for funding, 75 percent of the applicant's usage must take place within California.

2. Truck Stop Electrification

Installation of electric power infrastructure at truck stops, or truck stop electrification (TSE), is gaining support as an idling reduction strategy. Under this option, trucks would be provided with 110 volt alternating current (AC) electrical power at truck stops to run the electric air conditioning, heating and onboard appliances. The electric supply can also be used to charge on-board batteries for electricity use away from the truck stop. Truck stops would need to be equipped with electrical outlets throughout the parking spaces and trucks would need to be equipped, at a minimum, with inverter/chargers and electrical power connections. If fitted with batteries, the truck

could use electricity away from the truck stop. The inverter/charger is used to charge the truck batteries and to convert the truck's 12 volt direct current (DC) batteries to 120 volt AC power for all onboard appliances. Currently, AC power inverters that are built into the truck are offered as a factory option by Freightliner, Volvo and International. The cost for inverter/chargers is approximately $1,400, a 600-700 Ah lead acid battery pack (good for about 8-15 hours of HVAC and appliance operation) costs approximately $8,000.

As discussed above, the Carl Moyer Program would pay up to $5,500 toward electric equipment on-board the truck and up to $3,400 for its installation. TSE infrastructure installation at truck stops costs approximately $2,000 per truck parking space. District matching funds may be used to offset this cost.

3. Advanced Truck Stop Electrification

An alternative to the TSE system that does not need truck modifications has been introduced by IdleAire Technologies. This system provides heating and air conditioning to the truck, as well as electrical power for on-board appliances. It also provides basic services such as telephone and internet access and cable or satellite television. The unit is connected to the truck through a console mounted to the truck window using a template insert. The console contains all the necessary connections and controls, including a card reader for the billing system. The infrastructure cost is approximately $17,000 per parking space but may vary depending on the number of parking spaces installed.

Several advanced truck stop electrification projects have been installed with state and local funding. Staff is proposing to allow Carl Moyer Program funds to be used for installing advanced truck stop electrification systems (e.g., IdleAire systems). In these cases, a partial payment would be made upfront to help offset the initial capital investment. The remainder of the grant amount would be paid out in installments based on system utilization. The amount of the initial payment and subsequent installments will be determined on a case-by-case basis.

The truck idling reduction projects described are just a few of many zero-emission idle reduction strategies. Other technologies and projects may also be eligible for Carl Moyer Program funding on a case-by-case basis. As with all projects, emission reductions must be surplus, real, quantifiable, and enforceable and the project must meet the cost-effectiveness threshold of $14,300 per weighted ton of emission reductions.

F. Transportation Refrigeration Units

Electric standby transportation refrigeration units allow the engine to be turned off when a compatible electric power supply is available to operate the transportation refrigeration unit (TRU). Diesel engine emissions are eliminated while the TRU is plugged in at the facility. TRU manufacturers currently offer an electric standby option on most models

but very few trucks operating in the United States – less than one percent of trucks with TRUs – opt for these units. Electric standby TRU models are common in Europe where approximately 90 percent of all truck TRUs have some type of electricity plug-in capability. As currently designed, however, the electric motors are only sized to hold a temperature set point and may not have sufficient power to pre-cool large trailer enclosures. This technology does not reduce emissions when the vehicle is away from an electricity source.

Electrically-driven TRUs could, in the long term, be powered by fuel cells. This would allow the TRU to operate emission-free while enroute or when stopped at a facility, regardless of the availability of electricity. As previously mentioned, fuel cell technology for this application is not currently market-ready.

ARB is proposing to evaluate zero-emission TRU projects on a case-by-case basis. Criteria for other TRU projects are discussed in Chapter Four of the proposed Carl Moyer Program Guidelines.

G. Other Zero-Emission Projects

This chapter addresses some of the most likely zero-emission technology projects. It is by no means a complete list of zero-emission technology projects. Other zero-emission technology projects either require no special consideration (e.g., an internal combustion engine is directly replaced with an electric motor) or are described in the appropriate chapters (e.g., electric TRUs and power plug-in units to reduce locomotive idling). Zero-emission technology projects not specifically addressed in this chapter or elsewhere in the proposed Guidelines may be considered for Carl Moyer Program funding on a case-by-case basis. As with all projects, emission reductions must be surplus, real, quantifiable, and enforceable and the project must meet the cost-effectiveness threshold of $14,300 per weighted ton.

ARB staff will continue to work closely with interested stakeholders to monitor technological developments in effort to determine when it may be appropriate to develop or modify criteria for zero-emission projects. If necessary, ARB will issue advisories to inform prospective applicants and districts of any new policy developments regarding Carl Moyer Program projects using zero-emission technologies.

On September 6, 2005, Governor Schwarzenegger signed Senate Bill 467 (Lowenthal) which requires the ARB to revise the Carl Moyer Program Guidelines to include projects in which an applicant turns in off-road equipment powered by internal combustion engines and replaces that equipment with new zero-emission technologies. This legislation will take effect on January 1, 2006. ARB staff will evaluate how to incorporate the requirements of this legislation into the Carl Moyer Program in 2006.

IV. References

Brodrick, C .J., N. P. Lutsey, Q. A. Keen, D. I. Rubins, J. P. Wallace, H. A. Dwyer, and S. W. Gouse III, Truck Idling Trends: Results of a Pilot Survey in Northern California, Society of Automotive Engineers, Technical Paper Series 2001-01-2828, Warrendale, PA, 2001.